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A

TREATISE

ON

FOREIGN BODIES

IN

SURGICAL PRACTICE

BY

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TREATISE ON

FOREIGN BODIES

IN

SURGICAL PRACTICE.

PART III.—FOREIGN BODIES IN THE AIR-PASSAGES.

CHAPTER I.

GENERAL CONSIDERATIONS.—HISTORY.—DIVISION.

The extreme gravity of the accidents produced by the presence of foreign bodies in the air-passages, and the terrible symptoms which accompany their introduction, have, from an early period, attracted the attention of physicians to this question.

1*st period.*—Hippocrates had devised catheterism of the larynx in order to relieve the suffocation, but the idea of opening directly into the air-passages was first entertained by a Roman physician named Asclepiades, who had no opportunity of putting it into practice, and was long exposed to the raillery of his contemporaries and successors. They adduced, in opposition to this view, the impossibility of the recovery of divided cartilages; and it is for this reason, and in order to avoid this imaginary inconvenience, that Antylus, Oribasis, Ætius, and Paul of Egina successively proposed a transverse section between two rings of the trachea. The Arabians, the heirs of the old medical traditions, did not dare to perform bronchotomy, with which they were acquainted, from an unfortunate excess of timidity. Avenzoar alone performed the operation on a goat. We must wait a very long time, viz., to the beginning of the sixteenth century, before we find that surgeons performed bronchotomy, which even A. Paré passes by in silence.

To Louis belongs the credit of having claimed for Habicot, in the Memoirs of the Academy of Surgery, the right of the honor of the application of the opening of the air-passages to relieve the symptoms produced by the presence of foreign bodies. In fact, Habicot's little book was published twenty years prior to that of Frederic Monavius, which did not

appear until 1844. But Habicot only pointed out the way toward the rational employment of bronchotomy in cases of foreign bodies in the larynx or trachea, as he did not perform the operation with success except to relieve the symptoms of suffocation produced by the arrest of a foreign body in the œsophagus.

About this time a surgeon, of whom Verduc makes mention, had succeeded in removing a small bone from the trachea by cutting between two of its rings. Hitherto no one had dared to cast a doubt upon the old idea of the impossibility of the reunion of the cartilages, and this view dominates the entire first period in the history of foreign bodies of the air-passages until the time of Juncker and Heïster.

2d period.—Juncker and Heïster for the first time proposed a vertical incision of one or more rings of the trachea in order to remove foreign bodies, and the latter author succeeded in extracting a piece of mushroom and a bean. From this time on the well-described and well-regulated operation, including a variable number of procedures according as the incision was made directly or with the aid of a trocar, passes into practice, and, after the sanction accorded it by the old Academy of Surgery in consequence of Louis' celebrated treatise, was thoroughly accredited.

I reproduce from this author all the preceding details in the history of bronchotomy, as every incision into the trachea was called at this time. During this entire period, which includes the eighteenth century and the nineteenth up to 1820, facts were accumulating, and we find in authors much more precise notions with regard to the symptoms of foreign bodies in the air-passages and to the necessity of relieving them by a measure which is equally energetic and rapid. Side by side with the original and classical treatises of Hévin and Louis, must be placed those of Desault, Pelletan, etc.; these two authors had made advances in surgical therapeutics—the first by devising and the second by performing thyroid laryngotomy (1788). At the same time Vic d'Azyr advised incision of the crico-thyroid membrane, which was performed at a later period by Krishaber.

3d period.—Thanks to the works of Bretonneau and Trousseau, tracheotomy became a better regulated operation, and came into much more general use.

On the other hand, the study of the pathology of the air-passages, owing to the discovery of auscultation and percussion by Laënnec, became much more perfect. Dupuytren drew attention to the new diagnostic signs, and treatment becomes more effective the more certain our knowledge. At this period Boyer devised laryngo-tracheotomy, Vidal and Malgaigne, sub-hyoid laryngotomy. But the latter operations made much slower advances than tracheotomy, which soon gave unlooked-for results. For fifty years a very large number of tracheotomies has been performed in order to remove foreign bodies, and until late years, when the appearance of galvano-caustic and Paquelin's cautery gave some contemporary surgeons the idea of employing them in order to traverse the integuments and trachea, the plan of operation had not been modified. Among them I will mention Verneuil, of Saint-Germain, and Krishaber. At the same time the methods of diagnosis became more precise, and the introduction of the laryngoscope in practice permitted an examination of hitherto inaccessible orifices and cavities in the larynx. In conclusion, efficient therapeutic measures have been known for a long time, but it is only within recent times that progress in science has enabled us to regulate their employment. It was reserved for the immortal discovery of

Laënnec to enable us to determine the signs of foreign bodies in the bronchi. Dupuytren contributed a great deal to the history of those objects found in the trachea, and the laryngoscope, in doubtful cases, has shown the precise situation of some of these foreign bodies. There is no doubt that none of the methods are perfect, but a more exhaustive study of the etiology and symptomatology of foreign bodies of the air-passages will contribute to their perfection, and the important investigations of the last twenty years have made this question one of the most interesting and best known in pathology. Among the most important I will mention Aronssohn's thesis (Strasburg, 1856), the treatise by Gross, of Philadelphia, the works of Durham and Bertholle (1856), and the article by Guyon in the Dictionnaire encyclopédique (art. "Larynx"). All have contributed useful articles, and it is possible to base a complete study of foreign bodies of the air-passages upon the thousands of observations recorded in literature.

Division.—Properly speaking, every solid, liquid, or gaseous substance, except atmospheric air, is included in the class of foreign bodies of the air-passages. As thus defined, the subject is extremely broad; it embraces all respirable or irrespirable gases which do not enter into the composition of air, all vapors except that of water, and all the powders which an infinite variety of circumstances may introduce into the bottom of the pulmonary alveoli. With the large majority of authors, I leave out of consideration in this study the introduction of gaseous foreign bodies and the pneumoniokoses produced by the accumulation of mineral or vegetable dust. At the most they will be discussed incidentally whenever the pathological history of these affections will be of use in that of the larger bodies, to which we are in the habit of restricting the term foreign bodies of the air-passages.

Foreign bodies of the air-passages are therefore naturally divided into fluids and solids. The history of the first is much less interesting and important than that of the second, because it does not involve such efficient and precise therapeutic considerations. The amount of time devoted to these two parts will therefore be very unequal.

CHAPTER II.

FLUID FOREIGN BODIES.

Nature of Fluid Foreign Bodies.—A large number of fluid substances may play the part of foreign bodies in the air-passages. Some come from the outer world, and usually enter the respiratory channels at the moment of their entrance or exit; the others exist normally in the body, like the blood, or are the result of a previous pathological process.

In the order of frequency, we may classify these various substances in the following manner: drinks, especially water, medicinal fluids, pus, blood, softened tuberculous matter. The fluids sometimes have a somewhat more complex composition, such as happens when the substances are derived from the vomit, and which have caused severe accidents in some cases.

All these fluids vary greatly in their origin, consistence, and physical and chemical properties. While some, like water, are not very irritating and are very well tolerated by the mucous membrane lining the air-passages, others, like tincture of iodine, camphorated alcohol, etc., add their special irritating action, which we must carefully take into account to the noxious properties which are common to all liquids.

The drinks are very variable, as we readily understand, but these liquids rarely enter in large quantity. These substances are usually very fluid, and this slight consistence characterizes all the foreign bodies which enter from without. On the contrary, the organic liquids which force their way into the trachea (blood, pus, etc.) are much less fluid, and this fact is not immaterial with reference to the accidents which they produce. Contrary to what occurs when the liquids are derived from drinks, it is not rare to find them in large quantity, sometimes even more than a litre. Furthermore, the former are cold, while the latter possess the temperature of the body; the former are unchangeable, but the latter, the blood, for example, are coagulable either spontaneously or under the influence of the air. All these small distinctions enable us to understand the differences in the action of these liquid foreign bodies upon the respiratory system. But these are only some of the data in the problem whose solution varies in each particular case, as we shall soon see.

Liquid foreign bodies of physiological origin.—If we pass in review the various causes which favor the introduction of liquid foreign bodies into the air-passages, we are immediately struck by their infinite variety.

At one time a person has swallowed "the wrong way," or it is due to hæmoptysis, injection into a wound of the chest, etc. The only means of putting some order into this indefinite series is to range all the cases into two grand classes:

1. The introduction is due to a physiological cause.
2. The introduction is the effect of a pathological process.

All the cases belonging to the first class have a common path of entrance, viz., the glottis; but the reverse is not true, and a large number of cases of the introduction of fluids into the trachea are due to a pathological change of this part. In order to thoroughly understand the mechanism by which fluids from the stomach pass into the larynx, we must recall some points in the normal physiology of their deglutition. Before swallowing a draught, we separate the part which is to be swallowed from that which is not, by an unconscious and instinctive mechanism; in a word, separation of the liquid mass is an indispensable condition of deglutition. At the moment when the liquid flows behind the tongue, the movement of deglutition results in an elevation of the entire larynx below the base of the tongue and in closure of the opening of the glottis by means of the epiglottis which acts as an inclined plane, upon which gliding readily occurs. The entire mass does not pass along the median line; one part flows over the lateral parts before falling into the pharynx and œsophagus. Hitherto it is difficult to understand the introduction of liquid into the air-passages, and it appears as if this efficient protection should never be at fault. This is, however, not so, owing to the necessity of breathing during the ingestion of food.

An individual naturally makes a certain number of movements of deglutition without breathing. But this imperious necessity soon disturbs both physiological acts, which cannot occur at the same time. From this lack of equilibrium arise the various conditions which lead to the introduction of liquids into the larynx. Thus whenever, while drinking,

we do not sufficiently separate the liquid mass, we are liable to have some "go down the wrong way," and a small quantity enters the larynx. Infants who suck the bottle with too much avidity are almost always subject to this accident, and whoever watches them for any length of time will be convinced of this fact. In adults the passage of drink into the wrong channel is a much rarer event, in the physiological condition, as an effect of this cause. Nevertheless it is produced under some circumstances as in the infant.

Whenever the ordinary method of drinking liquids is changed for another, which consists in letting the fluid fall directly to the back of the fauces, the deflection becomes more frequent, because the ordinary conditions of deglutition are changed. The separation of the liquid does not occur in the same manner when an individual drinks from a glass as when he drinks without touching the vessel with his lips. While the first form of prehension is natural, the latter is purely artificial, and demands a certain amount of skill in order to prevent the introduction of the fluid into the glottis. The effect of this skill is to learn how to divide the liquid and not to permit it to suddenly penetrate *en masse* into the pharynx.

Whatever may be the cause, the effect produced is the following: a large amount of fluid arrives in the pharynx and does not find a sufficient passage; it regurgitates, lifts the epiglottis, and immediately produces suffocation by dropping into the larynx. This cause is very evident in the following case, and is added to the inspiration produced by a feeling of surprise.

Observation.—A child was chewing some coal; the mother surprised him, and made him hurriedly drink some water. A part of the fluid fell into the trachea, and rapidly produced death. (Monteggia Ins. chirurg.)

By the side of these physiological disturbances of the act of deglutition must be placed some others of reflex origin, sometimes voluntary, but usually involuntary, which play a very important part in the introduction of fluids. These include sneezing, coughing, laughing, etc. All these phenomena act in the same manner in favoring this entrance, arising from their peculiar mode of production. In fact, the paroxysm of coughing, like sneezing or laughing, is composed of nothing but more or less vigorous, interrupted, and convulsive expirations.

That of sneezing is the most violent, that of coughing is also very violent, and laughing, in certain persons, presents this characteristic to a high degree. Inspirations are necessary in order that these acts should be produced and repeated, and, if fluid is swallowed at this moment, it will enter the larynx with the air, as every inspiration is accompanied by forcible descent of the larynx, by raising of the epiglottis and opening of the glottis. A noise, cry, or speech may also produce a similar accident by the same mechanism. But the accident is much less frequent under the latter conditions, because the necessity of inspiration is not manifested with such an imperious and irresistible intensity as in sneezing or coughing.

To these causes must also be added an infinity of others, such as surprise, fear, very hot condition of a liquid, its chemical properties, its taste, etc. We must also take into consideration the position occupied by the patient, whether he is lying down or standing, for every one knows that the deglutition of fluids is dangerous and difficult in the horizontal position.

Liquid foreign bodies of a pathological origin.—A large number of diseases of the larynx, trachea, and lungs predisposes to the introduction of liquid foreign bodies, by modifying the usual conditions of deglutition and respiration, and by involving the integrity of the walls of the air-passages. Whatever may be their origin, we can attribute all these facts to two great causes: on the one hand, alterations in the general or local sensibility; on the other hand, all the organic changes in the respiratory or neighboring organs.

1. *Alterations in the general or local sensibility.*—Whenever the nervous sensibility diminishes in all parts of the respiratory system, the chances for the introduction of liquids increase. Thus any paresis or paralysis which involves the fauces and larynx, which palpably disturbs deglutition and produces a disturbance in its movements, will result in the entrance of liquids. In these cases the mechanism is not the same as in the preceding ones. It is no longer the inspiration of air or the reflux of too large a quantity of liquid which comes into play, but the absence of the nervous stimulus necessary to produce the reflexes and the movements of deglutition. The larynx does not ascend, and the tongue is not lowered upon the epiglottis, so that the liquid can enter the larynx, which remains open. This class of accidents is not very rare in diphtheritic and scarlatinous paralysis, and in the complete or incomplete paralysis following certain central affections. The other pathological causes act in a thousand different ways to produce the same effect, and these are the most frequent. I will pass in review, in succession, those due to changes in the larynx, pharynx, trachea, and lungs. It is easy to understand that any organic alteration of the epiglottis will especially favor the introduction of liquids. In fact, if the lid which closes the vestibule of the larynx is wanting, the chances of penetration are increased. I do not imply that the introduction of liquids is then inevitable, but there is much greater cause for its production than in the normal condition, and all extensive ulcerations of this fibro-cartilage produce this result. The same disorder also occurs when the epiglottis is bound down by pathological adhesions, and cannot fulfil its functions, when it is swollen from acute inflammation, or destroyed by traumatism, examples of which have been reported by Larrey[1] and Percy.

Finally, we must also mention abscesses near the epiglottis, the discharge of which sometimes causes the pus to enter the air-passages. Vidal de Cassis, among others, states that he has seen an abscess in the ary-epiglottic folds which had opened into the larynx and suffocated the patient.[2]

We must also remark that organic affections of the larynx, outside of those which produce pus or blood, predispose very little to the penetration of liquids. We find, in fact, that patients suffering from extensive laryngeal ulcerations, or very grave lesions of the cartilages, are not exposed to this variety of accidents so long as the epiglottis is intact and functionates regularly.

The phenomena do not run the same course when there are wounds in the larynx, especially those transverse wounds which are so frequent at the level of the thyroid cartilage. It is rare that they are not accompanied by a very grave hemorrhage and that the blood does not enter the larynx and bronchi.

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[1] Larrey: Chir. chirurgicale, T. II., p. 142.
[2] Vidal de Cassis: Éléments de pathologie, T. III.

The trachea does not predispose to the introduction of liquids, unless there is an opening in one wall, either as the result of injury or of a deep ulceration which puts it in communication with the œsophagus or a large vessel in the neighborhood. The operation of tracheotomy is not free from these annoyances; the penetration of blood into the trachea is so frequent that even to-day it constitutes the danger on account of which a considerable number of operations fail, and which gives rise to a large number of operative modifications. Not only do tracheotomy and fistulous wounds of the trachea favor the penetration of blood, but they also act disastrously in another manner, by producing disturbance of the act of deglutition, by a mechanism which we do not thoroughly understand. It is a matter of observation that patients who wear tracheotomy canulæ are more subject to the entrance of fluid into the larynx than others.

Under other circumstances, the trachea is thrown into accidental communication with the œsophagus by an ulceration of very variable origin. Sometimes œsophageal foreign bodies produce gangrene and ulceration by pressure upon the posterior wall of the trachea; at others tracheotomy canulæ, which have been left for years, have finally produced ulceration of the trachea and œsophagus, on account of their pressure upon the posterior wall of the former.

When the communication established between the two canals has become very large, the penetration of fluids derived from drinks becomes possible during their descent in the œsophagus, and the gravity of the symptoms of suffocation sometimes leads to the most disastrous effects. Authentic examples of all these varieties are scattered throughout the literature, and it is well to know them, since the progress of science will make them disappear.

En résumé: Blood and pus may penetrate from abscesses or wounds, and drinks through œsophageal ulcerations. In order to be complete, we must also mention medicinal fluids, such as perchloride of iron which imprudent hands have introduced into tracheotomy wounds in order to arrest the hemorrhage.

Though ruptures of aneurisms into the trachea are very rare, they nevertheless exist, and their rapid gravity does not merit our attention, because, as Louis remarked in his treatise: "Art can achieve nothing when no interval elapses between a condition of perfect health and death."

The majority of pathological fluids observed in the trachea and bronchi are derived from the lung and other adjacent organs. Every one knows, in fact, that hæmoptysis is very frequent in phthisis, that pulmonary apoplexy produces the same effects, and that aortic or other aneurisms have been known to open into the bronchi.

I will mention, as a curiosity, the possibility of the ulceration of a large vessel by a solid foreign body fixed in the air-passages. The literature of the subject presents a single example.

At other times pus suddenly bursts into the air-passages, and produces the class of accidents to which the term "vomica" has been applied. It either arises in the lung itself, and results from an abscess of the parenchyma, or an accumulation of tuberculous matter, or it is due to a purulent extravasation from the pleura, and even, in some cases, from abscesses of the liver.

Cases have been reported, especially after injuries, of the escape of bile from the bronchi. In this manner, also, medicinal fluids are introduced, which, being injected into penetrating wounds of the chest, or into abscesses which communicate both with the external air and the bronchi,

can thus penetrate into the trachea. Examples of this kind are not very rare, and in Prof. Gaujot's service, at Val-de-Grâce, I saw a soldier, who was wounded in the war of 1870-'71, in whom injections of the tincture of iodine penetrated in this way into the bronchi, and there produced very distressing paroxysms of suffocation.

These are the causes which favor the penetration of fluids into the air-passages; we must also add that this introduction may result accidentally from a change of the surrounding medium, as, for example, from air to water. In this manner water is introduced into the trachea during submersion; the instinctive inspiration introduces it instead of air, and death rapidly ensues from asphyxia. A case has been reported of the introduction of amniotic fluid into the trachea of a new-born babe, and I think that the mechanism during submersion will also hold good in this case in all respects.

Finally, a certain pathological symptom, viz., emesis, is sometimes the cause of the introduction of fluid into the larynx, either from the violence with which the expelled column lifts the epiglottis and forces it to open, or on account of the excessive quantity which suddenly bursts into the pharynx. At all events, authors have noticed that whatever hinders the exit of vomited matters, favors their introduction into the larynx ; and, in this regard, Vidal de Cassis [1] relates that an orderly at the Charité, being gorged with wine, was beginning to vomit, when he noticed Corvisart. He then closed his mouth in order to hide the proofs of his indiscretion, but the matters passed into his larynx, and the unfortunate man was immediately asphyxiated. This case, which presents a great analogy with those of Laënnec and Mérat, of which it is merely a variety, has attracted the attention of authors. Foville, in his treatise, endeavored to determine the cause of death after vomiting.[2]

Parrot observed an infant who died from the entrance of chyme into the air-passages; the bronchial mucous membrane had begun to undergo digestion.[3] Behrend and Piégu have quoted analogous cases.

According to A. Foville, several causes intervene in the introduction of vomited matters into the air-passages in persons who "vomit askew." He admits, with Mérat, that a sudden inspiration may cause these substances to enter the larynx. In other cases the expelled liquids find the mouth and nasal fossæ hermetically closed by the spasmodic contraction of the muscles. Active voluntary efforts and the initial period of an epileptic attack will produce, according to him, this powerful closure.

Symptoms produced by the Presence of Liquid Foreign Bodies in the Air-passages.—I will first take, as a type, some water, or simple drink, which "has gone down the wrong way" in small quantity. The first symptom is a violent, convulsive cough, preceded by a short period during which the irritated glottis contracts energetically. These rapid alternations of inspiration, contraction of the glottis, and of expiration, constitute in themselves the phenomena of suffocation, and cause congestion of the face, which assumes a characteristic appearance, which is too well known to render it necessary to revert to it here.

This attack of suffocation lasts for a few minutes when the quantity of fluid introduced is not considerable (a few drops, as ordinarily happens). The latter is soon rejected by the expulsive efforts. The cough and en-

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[1] Éléments de path., T. III.
[2] Archiv. gén. de méd., 6e Série, T. XIV., p. 5.
[3] Union médicale, 1868, T. II., p. 167.

tire array of symptoms decrease gradually, so that at the end of a quarter of an hour nothing remains but a slight feeling of distress or fatigue in the pharyngeal region. If the cause of the penetration disappears, and is not reproduced, the accident possesses no gravity and usually passes unnoticed.

But the symptoms are not always presented in such a simple manner, because other fluids than water are not all so well tolerated as it is. The colder they are, the greater and more persistent is the irritation they produce. The quantity also plays an important part in the production of the accidents. In fact, the liquid descends much deeper into the air-passages than in the preceding case, in which a few drops, which have been deflected from their primary destination, barely pass below the larynx. But when it enters in considerable quantity, as in Vidal de Cassis' case, mentioned above, or in certain tracheo-œsophageal ulcerations, the liquid is introduced suddenly, falls immediately to the bottom of the trachea and bronchi, where it provokes a much greater irritation, although it may be less sudden than in the preceding case.

An extremely annoying sensation then develops, which lasts but a short time, because it soon gives place to suffocation, dyspnœa, and to a very distressing, convulsive, tracheal cough.

If the quantity of fluid ingested is somewhat considerable, the air, during forced expiration, immediately traverses the column of liquid which accumulates in the bronchi, and the ear, even at a distance, can very distinctly distinguish a coarse, intermittent, tracheal râle, accentuated during expiration. Every one knows the agonal râle produced by an accumulation of mucus in the bronchi—a sonorous râle, which does not differ from that produced in cases of the ingestion of a considerable quantity of liquid.

In vigorous subjects the very active expulsive efforts prevent us from noticing this sign, but in persons who are enfeebled by other affections it can be very clearly distinguished. I will soon recur to the various terminations. It suffices, at present, to state that the symptoms may be restricted to a few paroxysms of suffocation, after which quiet ensues, or that their persistence and increase often produce fatal asphyxia.

In a general way, the pathological liquids derived from the lungs or from a wound, such as blood or pus, produce the same symptoms as water; but there are some peculiarities which result from the quantity of the penetrating fluid, and also from its qualities. If it enters slowly and in small quantity, as in cases of narrow ulceration of vessels or bronchi, the symptoms are slowly produced when the quantity is sufficient to produce irritation, and during this time the liquid may undergo some modifications. This occurs with regard to the blood from hæmoptysis and pulmonary apoplexy. But it is very difficult to understand why the blood is slightly coagulated in some cases and not in others.

The modern authors who have written upon this subject have not drawn attention to the mechanism by which hæmoptysis is produced. It is an undoubted fact that some phthisical patients sometimes expel a large quantity of blood, as if it had been vomited. Everything leads us to believe that it had accumulated in the diseased bronchi until the irritation produced was sufficient to produce cough and the expectoration of the liquid mass.

This is a very peculiar mechanism, which differs from that observed in cases of vomica or the opening of an abscess into the bronchi. It appears that in phthisical patients the bronchial mucous membrane, which

has been diseased for a long time, loses its habitual irritability, so much the more as the blood, at the normal temperature, is not more irritating than the secreted pus. When a stream of blood, in the case of the rupture of an aneurism, or a stream of pus, in the case of the opening of a large collection into the bronchi, penetrates into the air-passages, the primary symptoms are extremely grave and very marked. We then observe suffocation, convulsive cough, agitation of the patient, puffiness of the face, and turgescence of the veins of the neck. All the signs of asphyxia are expressed in the countenance, until a convulsive cough, attended with abundant expectoration, discharges a part of the fluid. If the vital energies have been exhausted for a long time, we only observe the first stage of asphyxia: coarse tracheal râles pass through the liquid mass which encroaches upon the entire bronchial tree, and death occurs almost immediately. When the first symptoms have subsided, a marked improvement will occur within a short time, if the entrance of fluid diminishes or ceases, as in case of abscess.

The introduction of medicinal fluids into the bronchi from abscesses or wounds of the chest gives rise to the same phenomena as when it occurs in the larynx. The patient at first experiences a very sharp pain in the chest, which excites him to cough, and produces very persistent paroxysms with suffocation. Death may sometimes result from the accidental passage of these fluids into the air-passages.

Terminations.—1. *Spontaneous expulsion.*—This is the most frequent termination whenever the quantity of fluid is not considerable ; the slight gravity connected with the inspiration of a few drops of water is known to every one. As long as the primary symptoms exist, a slight uneasiness is experienced ; it soon disappears when the cough ceases. The fluid particles, being immediately expelled, are thrown with great force into the posterior part of the nasal fossæ at the same time as the other alimentary particles.

The same termination may also be observed when the fluids enter in larger quantity; but it is not constant, as we shall soon see.

All pathological fluids which enter the bronchi and trachea have a tendency to be expelled. In order that this condition should be realized, the force of expulsion must be sufficient ; this does not obtain in some cases of general or local paralysis.

Without the point of support which the contraction of the glottis gives to the effort of the expiratory muscles, the expectoration may not be efficient, and the expulsion is insufficient.

In this category of ideas we will find the reason for the differences which exist between a still vigorous patient who forcibly expels several litres derived from an abscess of the liver or from empyema, and another who, having arrived at the last stages of cachexia, has not sufficient power to expel a few teaspoonfuls of pus starting from the rupture of a cavity.

2. *Absorption of fluids in the air-passages.*—If a part of the fluid is expelled, another part is undoubtedly absorbed, as is evident from the very curious experiments made in England by Goodwin (1788) upon cats, and more recently by Grohier (1816) upon horses. Other experimenters have since verified the exactness of this curious property of absorption, which is so developed that we may introduce sixty grammes of water in the trachea of a cat and several litres in the horse without suffocating them. Prof. Küss, of Strasburg, based upon this fact an original treatment of cholera : he thought that the extreme loss of aqueous fluids in the economy could be relieved by the injection of water into the trachea and

the utilization of the absorbent power of the mucous membrane. But we must not exaggerate the importance of this peculiarity in the condition in question. All pathological fluids cannot be absorbed, and before its occurrence many of them produce a series of accidents whose sudden appearance can only be prevented to a slight degree by the absorbing power. I do not think that we can compare, in all respects, an injection made into the trachea with the introduction of the same fluid into the bronchi or larynx.

This is proved by the fact that Trousseau had extolled medicinal injections into the trachea after the operation of tracheotomy, and that he would not have done so if they had not been well tolerated. We must, however, admit that this therapeutic measure has not proven successful, for reasons which I shall mention at a later period.

3. *Inflammatory accidents.*—We readily understand that irritating fluids, on account of their properties, temperature, and mere presence, will leave traces of their passage after their expulsion, and, in some cases, the production of tracheitis, bronchitis, and even of pneumonia, has been observed as the result of the injection of a certain quantity of drink. In addition to their slight value, this reason has contributed not a little to discredit Trousseau's tracheal injections. Moreover, it is not astonishing that fluids should sometimes produce these effects, if we remember that the simple contact of air very often produces them after the operation of tracheotomy, so great is the sensibility of the mucous membrane of the respiratory passages.

Caustic fluids, such as perchloride of iron, ammonia, etc., always give rise to very acute inflammations, which may be followed by serious consequences in those exceptional cases in which they do not produce asphyxia.

4. *Termination in death.*—Death is the result of the penetration of fluid into the air-passages whenever the asphyxia persists. If we find the primary symptoms increasing, the patients looking purple and black, the eyes fixed, protruding from the sockets and moving convulsively, we must dread a fatal termination, because this unequal contest will soon terminate in death.

It occurs in two different ways: either from an accumulation of fluid in the trachea and bronchi, which cannot be expelled, or in consequence of the phenomena of spasmodic contraction of the glottis. Thus Guyon[1] states that he saw sudden death result from cauterization of the pharynx with dilute ammonia.

In this case the surgeon attributed the death of the patient to the spasm of the glottis caused by the caustic. Guilt[2] has also reported a case of this kind.

Some observations have been made of sudden death from the accumulation of tuberculous matter in the bronchi, which could not be expelled, either on account of its greater consistence or the extreme feebleness of the patients. Geoghegan,[3] Vigla,[4] have reported such cases, and the literature presents some others. I witnessed an occurrence of this kind in a tuberculous patient who died suddenly during sleep, being asphyxiated from the opening of a large cavity into the bronchi and trachea. I

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[1] Dict. encyclop., art. Larynx.
[2] Thèse de Paris, 1843.
[3] Dublin Med. Press, and Gaz. méd., 1844, p. 434.
[4] Vigla: Arch. gén. de méd., 4ᵉ Série, T. XII., p. 153.

heard a few coarse râles passing through the fluid, but no effort could recall the patient to life, as he was so weak that he was unable to expel the fluid. His features expressed extreme anxiety and the signs of suffocation; the scene closed after a few ineffectual attempts at inspiration.

Diagnosis.—The diagnosis of the penetration of fluid is very easy, except in some pathological cases. We can usually obtain an exact clinical history, as the accident is produced during drinking, and has been immediately followed by distressing and temporary symptoms of asphyxia. But the determination of the cause is more difficult when the initial symptoms are slight, are frequently reproduced, and render the patients uneasy. In such cases we must bear in mind all the occasional physiological and pathological causes which may produce a deviation of fluid. We should then carefully examine the fauces, epiglottis, and ary-epiglottic folds with the laryngoscope, investigate the sensibility of the region, and assure ourselves of the integrity of the œsophagus. If the phenomena of suffocation appear when a wound is present, we should consider the possibility of the entrance of blood into the bronchi or trachea, and there will then be few chances of deception. Finally, a knowledge of the previous diseases of the patient may itself put us on the track of the diagnosis in cases of opening of "vomicæ" or of cavities filled with tuberculous matter.

Treatment.—This is naturally divided into prophylactic and curative treatment; while the first is addressed to the causes themselves in order to prevent their effects, the second refers to the latter.

1. *Prophylactic treatment.*—It is very difficult to indicate the measures which will render the accidental entrance of a few drops of fluid less frequent, since it usually happens by chance and coincident with the act of deglutition, over which we are not masters. But the action of the physician may become effective, if he finds that patients are suffering from organic lesions of the epiglottis, general changes of sensibility, laryngeal and pharyngeal paralysis, because in these cases we may foretell these accidents and prevent their return by appropriate treatment, consisting in the administration of drinks by means of an œsophageal sound. We also resort to preventive treatment when we employ all the necessary precautions during the operation of tracheotomy in order to prevent the escape of blood into the trachea.

2. *Curative treatment.*—The measures at the disposal of the surgeon for the relief of symptoms produced by the presence of fluid foreign bodies are very restricted. In the large majority of cases the accident has no bad consequences, and we may leave to nature the expulsion of the few drops of fluid which irritate the respiratory passages, by the efforts of coughing.

Furthermore, there is no middle course in the treatment of this class of foreign bodies. We must either leave everything to nature, if we are justified in believing that it can effect expulsion, or we must rapidly interfere, if the danger of suffocation continues, and perform tracheotomy. The quantity of fluid should not be the only factor to guide the surgeon and to make the indications, because, as we have seen, there are a number of cases in which a very small quantity of fluid may produce spasm of the glottis and cause asphyxia as readily as a flow of blood or pus. Then, whenever a fluid, such as pus, blood, water, etc., produces grave symptoms and threatens life, we must hasten to open the trachea. We should only except from this rule those cases in which blood, which has not started from a trauma, has penetrated the air-passages. The nature of the blood which is expelled, and the suddenness of the accident in the midst of per-

fect health, are the signs which enable us to recognize the source of the evil. No one will imagine that we can do anything to relieve the rupture of an aneurism which has opened into the bronchi. With the exception of cases in which the blood is not produced by a traumatism, tracheotomy should be performed in the ordinary way. If necessary we can then make insufflations of air into the trachea, either by means of a catheter or directly.

The mere introduction of air may produce cough and facilitate the expulsion of the fluid, by exciting pulmonary sensibility. Under some circumstances direct or indirect suction has been applied to the bronchi either by means of a catheter or even by suction of the edges of the wound. These measures have been especially useful at times in wounds of the neck involving the larynx or trachea. They are equally susceptible of application in cases in which pus or tuberculous matter has entered, but aspiration must then be made with the aid of a rubber tube or aspirator. Whitcombe highly recommends this practice.

In addition to these measures, it will be well to add the treatment by position; for this purpose the physician places the patient in dorsal decubitus, and then lowers the neck and chest in such a manner as to facilitate the discharge of the fluid.

In drowned individuals this mechanical measure sometimes gives good results, but it must not be prolonged for more than a few minutes, as it then becomes dangerous. If the case is less urgent, we may merely place the patient on the belly or side in order to facilitate the escape of the fluid. Hitherto I have supposed that the blood started from an accidental wound of the trachea; but what should be done when the accident occurs during the operation of tracheotomy, as so frequently happens? The first indication is to remove the source of blood by producing hæmostasis of the wound by the ordinary measures (forceps, compression, etc.). In addition, we should make the patient breathe deep and incline the head to one side, in order to facilitate the expulsion of the blood and tracheal mucus through the opening, which is kept widely open by means of dilating forceps. Finally, it will be well to employ suction, or to follow the plan adopted by Virgili in the following classical case :

Observation by Virgili.—Tracheotomy.—Penetration of blood into the trachea.—A Spanish soldier, æt. 25 years, was affected with so acute an inflammation of the larynx that no other resource except bronchotomy was left to Virgili. He made a longitudinal incision through the integuments and opened the trachea transversely between two rings. But the opening was no sooner made than the blood, which flowed from small open vessels and passed into the trachea, excited such a violent cough that the canula which was introduced into the wound could not be kept *in situ*, although it was several times pushed in its place. The patient breathed very little or not at all, and the blood which continued to enter the trachea markedly increased the danger. Virgili determined to open the trachea longitudinally, down to the sixth cartilage. He had the satisfaction of seeing that, as soon as the second operation was made, the patient breathed more easily, and the pulse, which had been barely perceptible, began to reappear. The patient was then placed with the head hanging out of the bed and the face toward the floor, in order to prevent the blood from flowing into the trachea. The hemorrhage was arrested spontaneously within a very short time, and in a few days the wound had cicatrized.

CHAPTER III.

SOLID FOREIGN BODIES.

The study of solid foreign bodies in the air-passages includes all those which are accidentally introduced into the larynx, trachea, and bronchi. It appears more natural to study each part separately, but the similarity of symptoms, the difficulty of making an exact diagnosis, and the variations in the position which the foreign body may occupy, favor their combined consideration. However, whenever the clearness of the subject demands it, I will take pains to separate those cases which refer to each part, imitating in this respect the conduct of the majority of authors who have written on this subject.

Etiology.—The large majority of foreign bodies of the air-passages are introduced through the larynx, but some arrive by way of the lung, others from traumatisms of the trachea. Finally, we must also add to these various origins the formation of foreign bodies in the respiratory passages, especially in the bronchi. We can also regard the question from another standpoint, and classify them as inanimate bodies, organic and inorganic substances, but the preceding division is preferable, and I will follow it in a consideration of the causes which favor the entrance of foreign bodies.

1. *Foreign bodies introduced through the larynx.*—Certain individuals are more predisposed than others to the penetration of foreign bodies into the larynx, and the possibility of these accidents must be looked for in them. Among the predisposing causes, some are general, and refer to age ; the others are functional, and are usually the consequence of pathological changes in the organs and of the resulting disorders of deglutition.

There are two periods which especially predispose to the introduction of foreign bodies, viz., childhood and old age. Among one hundred and two cases collected by Aronssohn, there were forty from the ages of one to ten years, and only five from ten to twenty years, while the proportion grew sensibly larger as the number of years increased. The causes of this predisposition are various ; the chief ones in childhood are the bad habit which children have of putting into the mouth everything they grasp, joined to the restlessness of their ideas and impressions, which follow one another disjointedly, and make them forget the presence of these foreign bodies. In old age the alteration of general sensibility, the progressive enfeeblement of all the functional acts, the difficulty and imperfection of mastication, play a very important part in the introduction of foreign bodies. There is no doubt that some chance circumstance must always intervene, but it will find the most favorable conditions in childhood and old age. We find that a considerable number of the bodies consist of beans in children, and of pieces of meat, which have been hardly at all masticated, in old persons. To this purely mechanical cause we must add, in the latter, a very peculiar atony of the larynx, which no longer reacts under the influence of the contact of food, as usually occurs, and this atony produces disturbances of deglutition. Finally, the bad quality of food and impurities in it also contribute to the production of this class of accidents. Rochoux reported the case of

a man who swallowed the thread which held some leeks together. The initial cough, suffocation, and distress soon subsided to give way to disquieting symptoms of phthisis, which lasted from fifteen to eighteen months, when he expelled the thread in a fit of coughing, and recovered.

For a long time it has been asked whether the administration of chloroform during operations does not favor the introduction of foreign bodies into the larynx. Aronssohn decided this question in the negative, and remarked with justice that we do not know a single positive case which can be attributed to the anæsthesia, while it is not very rare to find foreign bodies introduced into the air-passages during the cries or groans emitted in the course of an operation, as we shall see later.

However, the following case proves that an absolute statement does not hold good in this regard, and that we must always be on our guard:

Observation.—Anæsthesia in extracting a tooth.—Falling of a cork into the larynx.—Death.—A young man, æt. 23 years, was anæsthetized with nitrous oxide in order to have a tooth extracted. A cork was placed between the teeth in order to keep the mouth open. The tooth was extracted, but slipped out of the forceps and fell with the cork into the fauces. The tooth was expelled by an act of vomiting, but the cork entered the larynx, and gave rise to a violent attack of suffocation, followed by death within an hour. The autopsy showed the presence of the cork in the larynx. (Cincinnati Lancet and Med. Observer, 1867.)

Another illustration is also reported in one of the journals. This also refers to a tooth, which was introduced into the air-passages, where it gave rise to severe symptoms:

Observation by Hertz.—Anæsthesia for the extraction of a tooth.—Fall of the crown into the trachea.—A woman, æt. 26 years, desired to have the right second lower molar tooth extracted during nitrous-oxide gas anæsthesia. The crown of the tooth was broken. Immediately after the operation, she had some paroxysms of coughing. At the end of two weeks she felt some pain in the lungs, and a body appeared to be moving up and down in the trachea. The left lung did not become affected until during the fifth week. During the last two weeks the patient was confined to her bed on account of weakness. Toward the end of the fifth week the crown of the tooth was expelled during a violent paroxysm of coughing. This was followed by immediate relief and very marked improvement. Recovery. (Dental Cosmos, 1873: Hertz.)

Deglutition is the most important of all the functional causes, and a large number of these accidents have occurred during eating or drinking, without the intervention of any mechanical, mental, or pathological cause. The mere fact of eating predisposes, to a certain extent, to this penetration, and I may also state that some substances, such as badly divided meat, present great frequency. The chances of deflection increase whenever the alimentary bolus is very large, when the acts of deglutition are voluntarily repeated with great rapidity, and when the patient eats with voracity. In these cases, by stimulating the power of the complex parts which are concerned in deglutition, we run the risk of altering its rhythm and harmony, which is almost always followed either by the expulsion of a part of the food into the posterior part of the nasal fossæ, when the alimentary bolus is surprised during expiration, or by the entrance of a portion into the larynx, when this disorder coincides with inspiration. The expulsion into the nasal fossæ is itself a circumstance which favors the introduction of alimentary particles. In fact, when foreign bodies are pushed into the nasal fossæ, they produce an irritation which instinctively leads the patient to make a strong inspiration through the nose. The current of air thus produced pushes the

substances into the pharynx, and very often into the larynx, with the air which penetrates this organ. In this manner a forced physiological functional act may become the source of numerous accidents.

This predisposition also exists under some exceptional conditions when deglutition acts upon spoiled articles and those which contain animalcula in suspension. The existence of leeches in the water is one of these circumstances, and it is found realized, with regard to the larynx as with the œsophagus, in persons who have drunk impure water coming from springs or marshes in warm countries. During deglutition the filiform leech (*hæmopis vorax*) adheres to the folds of the epiglottis, or enters the ventricle of the larynx. It produces very insidious and always grave symptoms, illustrations of which I shall have occasion to report. Among this group of cases belong the observations made by Vital, Lacretelle, Masséi, Clémenti, etc.

Pathological causes.—The pathological causes are either general and depend upon a multitude of affections which secondarily involve the pharynx and larynx, or they are local and depend upon some destructive change of inflammatory or diathetic origin. The general affections consist of paralyses involving sensation or motion, or both together to a variable extent at the same time.

Certain general diseases, such as diphtheria, scarlatina, and cerebral paralyses, may realize these conditions; and several important works, published upon this subject, in 1859, by Roché,[1] Maingault, Pérate,[2] and Tardieu, leave no doubt on this point.

The first of these authors reports "that a young woman, twenty-two years old, while convalescing from a severe angina, was affected with paralysis of motion and sensation in the velum palati, the entire mucous membrane of the isthmus of the fauces and that lining the entrance to the air-passages; she was suddenly seized with intense suffocation while dining, and died four hours afterward. A piece of cooked meat was found obstructing the left bronchus and the beginning of its two primary divisions. She had never in any way been cognizant of this defective deglutition." In another case a piece of meat obstructed the entrance to the larynx in the same way in a child suffering from paralysis of the velum palati. The same effects have also been observed after the ingestion of boiling or corrosive fluids which alter the sensibility of the region. Finally, there are circumstances under which this insensibility apparently has no cause, and persons have been known to swallow coins, artificial teeth, nuts (Denucé), etc., at night without feeling it.

All local affections which produce any disturbance in deglutition favor, to a certain extent, the introduction of solid foreign bodies, because they all have the ultimate effect of appreciably hindering the occlusion of the glottis by the folding of the epiglottis upon itself. We must acknowledge with Guyon that these affections have more influence upon the introduction of fluids, but I cannot admit with this author[3] that they do not have any appreciable effect on the penetration of solid bodies into the larynx. Jobert had also been led to deny the influence of the epiglottis in the closure of the larynx, by relying upon false physiological data. He stated, in fact, in a treatise presented to the Academy of Sciences, that foreign bodies pass through the upper opening of the larynx without

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[1] Soc. anat., 1859. p. 252. [2] Pérat: Thèse de Paris, 1859.
[3] Dict. encyclop., art. Larynx, p. 707.

raising the epiglottis, which is never lowered upon it, as has been believed, but that this organ is always upright in virtue of its own elasticity.

The following case, reported by Campbell, disposes of Jobert's theories, and, when added to other analogous facts, serves to show that Guyon has not attributed a sufficient part in the entrance of solid bodies to local affections.

Observation.—Sudden death produced by a piece of meat in the larynx.—Old changes in the epiglottis.—"Campbell saw a boarder at Sainte-Perrine who died almost immediately after the introduction of a piece of meat into the larynx. At the autopsy it was found that the epiglottis was adherent to the base of the tongue, and that the upper orifice was entirely closed by a piece of boiled beef, which was an inch long and weighed 8–9 grains. The epiglottis did not by any means have the usual dimensions. The opening could not be covered except by stretching the base of the tongue beyond measure. The accident was due to this retraction or atrophy of the median glosso-epiglottic ligament." (Arch. générales de médecine, 4e Série, T. VII.)

Acute or chronic inflammations of this region, adjacent phlegmons, cicatricial tissues, and extensive ulcerations of the epiglottis may, therefore, markedly interfere with deglutition and favor the entrance of alimentary particles. In this respect lesions of the epiglottis have much more influence than those of the larynx, and the latter may be very extensive without affecting deglutition. We must nevertheless make an exception in those peculiar cases in which necrosed pieces of the laryngeal cartilages have fallen into the trachea and have played the part of foreign bodies. (Hunter, O'Shea, Labbé, Bell, Gooch and Houston, Larrey.) In this manner fragments of the cricoid, thyroid, or arytenoid cartilages have been introduced by their own weight, or by the inspired air, as a consequence of syphilitic necroses or laryngeal phthisis. The following case, reported by Dowse, belongs to the same category:

Observation.—Death from the introduction of a piece of the palate-bone into the larynx.—"A piece of the necrosed palate-bone fell into the larynx in a syphilitic subject, who died from exhaustion, after having had paroxysmal attacks of dyspnœa, accompanied by wheezing. The laryngoscope did not disclose any lesion or the presence of the foreign body, which was situated in the ventricle of the larynx." (British Med. Journal, 1873.)

The lung itself or the adjacent organs may act as a source of foreign bodies; thus, a detached bronchial gland has been known to cause these accidents.[1]

Delasiauve has called attention to the frequency of the introduction of foreign bodies into the air-passages in epileptics. These accidents are especially frequent during the convulsions. In one case, which was accompanied by such slight symptoms that a laryngo-tracheitis was at first suspected, the patient had a paroxysm of coughing, and expelled a piece of the bowl of a pipe, which had been inspired during a fit, and had been unrecognized. On another occasion an epileptic had inspired an apricot-pit, which was followed by some annoyance, rather than by pain. Three months later he expelled it spontaneously. Finally, in a third case, the patient was believed to have acute œdema of the lungs, and very grave symptoms developed. Three weeks passed without any improvement. A button-mould, pierced through its centre, was expelled three months later in a paroxysm of coughing. The diagnosis was very difficult in all these cases, because the patients were unconscious of their actions at the time of the accident.

[1] Edwards, of Wolverhampton: Med. Chir Transactions.

The exciting causes vary a great deal, but they almost always act in the same manner, and the foreign bodies then enter the larynx by the same mechanism. In all these cases the introduction is effected by means of a powerful inspiration, sometimes voluntary, sometimes ill-timed, and very often unconscious and reflex. There are some examples of penetration by aspiration by means of a powerful inspiration made through the mouth, in which the air serves as a vehicle for the foreign body, which thus penetrates directly into the larynx, and more frequently into the trachea and bronchi.

Observation.—Reed of a whistle swallowed.—Death.—"A child, nine years old, while playing with a whistle, endeavored to produce a noise by strongly inspiring air through his instrument. The reed of the whistle was detached and immediately carried into the air-passages. It was found, upon autopsy, in the upper part of the left bronchus." (Aronssohn: Th. de Strasbourg, 1856.)

In another case, a child, placing himself at some distance from the edge of a table, inspired a melon-seed. Haughton [1] performed tracheotomy upon the child in order to extract the seed, which had followed the air and had entered the larynx. We may add to these cases that of a man, who, while sucking the leg of a lobster, swallowed some of the shell (Aronssohn); that of a bird-catcher swallowing a pierced fruit-pit, which served as a whistle. This accident has occurred several times in children, who rub down certain pits upon both sides in order to make whistles. In these cases the mechanism is very simple, and the chances for the penetration of the foreign body will increase the more regular and light it is and the greater the force with which the air is inspired. The accidents then occur as the result of a conscious inspiration.

But these cases are very rarely so well marked, and inspiration is much more often unconscious and sudden. The causes which frequently produce this accidental and, to a certain extent, spasmodic inspiration, are fright, surprise, laughing, coughing, a sudden shock, pain. In a word, they include all the causes which produce in man an instinctive movement of inspiration, and the cases in which this phenomenon is produced are much more numerous than we think. The following examples must be attributed to the effects of fright:

Observation.—A child, who was eating a nut in the street, was knocked down by a carriage; immediate symptoms of asphyxia. The nut had been suddenly inspired. (Aronssohn.)

Observation.—A soldier, while walking in the street and eating a plum, ran against a horse, was pushed aside suddenly, and swallowed the foreign body. Slight pain, no oppression, no convulsive cough. He expelled the pit, while coughing, twelve hours later.

In these cases the sudden movement produced under the influence of imminent danger has a very marked action; but this inspiration has also been observed even when there was no movement. In one case a bean has been swallowed by an infant, who was suddenly roused from sleep; in another case it was the mouthpiece of a trumpet which a child held in his mouth while playing, and which fell into the glottis at the moment in which some one tickled his neck (Benoit). Examples of this kind are very numerous; they are almost always complex, so that several of the previously enumerated causes act at the same time. This fact is well set forth by the following examples:

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[1] Gaz. hebdomadaire, 1858.

Observation.—Sudden admonition given to a child who was blowing a trumpet. He inspired the reed of the instrument. (Aronssohn.)

Observation.—A child, while eating cherries, was suddenly overturned by a pig. He inspired one of the pits. (Travers: Ann. de la chir. fr. et étrangère, pp. 375, 184.)

Coughing and laughing, by giving rise to a rapid succession of vigorous inspirations and expirations, may lead to the entrance of solid bodies into the larynx, especially during deglutition. A sudden explosion of laughter during a meal, and an unforeseen paroxysm of coughing, are very often the cause of this accidental penetration.

Hitherto aspiration at a distance, or a sudden movement of inspiration, has given rise to the introduction. In the following cases the necessity for violent inspirations produced by pain must be regarded as the cause of the accidents. During the extraction of a tooth the individual gives vent to groans, and the extracted tooth falls into the larynx. This example is not unique of its kind, and I have observed several cases. It has been the custom to attribute to the action of gravity the cause of a certain number of cases of introduction into the larynx, and all authors, since B. Brodie, reproduce the classical observation of the engineer Brunel, who swallowed a coin which was thrown into the air, and with which he amused himself by catching it in his mouth. The body either falls directly into the opened larynx, the head being thrown forcibly backward, or a violent movement of instinctive aspiration adds its share in aiding penetration. We must recall the marked, noisy movement of inspiration in dogs, who grasp at morsels that are thrown to them, in order to form an idea of the necessity of this movement of instinctive aspiration in man under the same circumstances, in order that the action of gravity should always be added to that of sudden inspiration.

The cause becomes even much more mechanical in some cases of accidents which have occurred during explorative manipulations made by incompetent persons, or by surgeons, in order to discover foreign bodies arrested in the pharynx. It is not rare to find the displacements, produced by the introduction of the finger, lead to the penetration of the foreign body into the air-passages.

Observation.—Match in the air-passages.—Death.—An infant, eighteen months old, introduced an ordinary match into the fauces. While attempts at extraction were being made, the match was displaced, and fell into the trachea. Tracheotomy, death from capillary bronchitis. (Cheever: Bost. Med. and Surg. Jour., 1876.)

In other cases of the same kind the accidents have not always been followed by such disastrous results, but they may be attributed to surgical interference, as in the following case, whose cause had baffled the sagacity of a very skilful surgeon:

Observation.—Death of a child suffocated by a tooth in the larynx.—Aronssohn reports that Prof. Rigaud had a child die under his hands whom he had operated on for double hare-lips. While advancing the lobule, and passing the pins, the child died. The autopsy showed the presence of a tooth between the lips of the glottis, and completely occluding its lumen.

A short time ago, Schroetter, of Vienna, published a case which belongs here, and which shows what care should be employed in the choice of instruments.

Observation.—A lady, suffering from laryngeal catarrh, had been pencilled several times with nitrate of silver. During one of the applications the patient was seized

with suffocation, the hair of the brush having fallen into the trachea. Schroetter made the patient inspire gently, and then cough violently, whereupon the foreign body was expelled. (Mon'schr. f. Ohrenheilk., X., 1876.)

Hitherto I have only considered the penetration of solid foreign bodies which have been introduced through the mouth or nasal fossæ. There are some which may come from the stomach, through an act of vomiting or a peculiar ascending movement. In this case solid and fluid bodies are almost always introduced simultaneously. This class of accidents, which is very frequent, rarely has such disastrous consequences as in the cases of Verduc, Morgagni, Laënnec, Corvisart, etc. L. Forsek has recently published a striking example observed in an idiot who vomited while eating, and suddenly died. Upon autopsy a piece of calico was found within the larynx.[1]

The foreign bodies which spontaneously enter the larynx from the œsophagus consist of live worms, which, after passing out of the pharynx, enter the glottis, where they soon produce grave symptoms. Oppolzer and Aronssohn have reported curious examples, and the latter author has insisted very strongly on their manner of penetration into the air-passages. Donati recently published an interesting case of suffocation and death caused by the penetration of a worm into the trachea of a child five years old. (Annali univers. di med. e di chir., Nov., 1878.)

Foreign bodies introduced through the trachea.—The solid foreign bodies which penetrate the air-passages through the walls of the trachea come from the outside through a wound, from the inside through a wound or perforation of the trachea. All these varieties have been observed, and the case reported by Lamartinière[2] is a classical example of traumatism.

Observation.—Pin lodged in the trachea.—Extraction.—Recovery.—"A child was playing with a whip, at the end of which a long, headless needle was fastened. The child was suddenly seized with suffocation, and was in danger of a rapid death, when Lamartinière, having noticed a red point upon the anterior part of the neck, placed his finger upon it. He felt an unusual resistance, incised the skin, and reached the end of the pin, hidden under the integuments and transfixing the trachea. The pin was removed, and the patient recovered."

Suë has observed an analogous case in which the penetration of the foreign body was effected from without inward. Alary, quoted by Hévin, extracted a portion of the wing of the thyroid, which was completely detached, from a wound in the neck. In consequence of gunshot wounds, the projectiles have been known to enter the trachea which they had perforated.

These accidents are especially produced in consequence of wounds made by tracheotomy, either because the foreign bodies penetrate through the canulæ, or because the canulæ or their fragments become detached. This latter accident, which appears so singular and of which Guyon[3] only reports one example, observed by Spence, is far from being rare in foreign countries in which tracheotomy canulæ are made of rubber or poorly adjusted metallic tubes. In this respect blame is attached to Durham's canulæ, many of these annoyances being unknown in France, where we use Trousseau's silver canulæ almost exclusively. This accident is especially produced in those cases in which they have become worn from

[1] Wien. med. Presse, T. XIV., 1873.
[2] Mém. de l'Acad. de chir., T. XIV., p. 221.
[3] Gaz. hebdom., 1862.

long service or from a poor arrangement of the mechanism which unites the external and internal cylinders. During the past few years the annals of science have been enriched with ten new cases of this kind, observed especially in Germany and England by Hulke, Holhouse, Ogle and Lee, Burow, Clément Lucas, etc. I shall have occasion to return to this class of accidents, which has created almost a new chapter in the pathology of foreign bodies of the air-passages, from the singularity of the symptoms as well as from the happy results of the bold, but well-defined manipulations which have been resorted to.

The foreign bodies which come from the interior penetrate the trachea by means of a communicating wound or perforation. The wounds are rare, but the latter mode of perforation may be the result of several œsophageal affections, especially of the presence of foreign bodies in the interior of that canal. Their history has been well studied by Vigla,[1] whose works I have laid under contribution in the study of foreign bodies of the intestinal tract. Bégin had also reported some examples, one of which was due to the presence of a coin.

When the perforation is small, only fluids pass, and it is not so rare, as Guyon thinks, to find that alimentary particles have suffocated the unfortunate victims of this affection; in fact, the majority die in this manner. Moreover, Lepelletier[2] has mentioned an example of penetration of a worm through a perforation of the trachea. This curiosity possesses an analogue in the case of penetration of the trachea by a necrosed fragment of the sternum quoted by Bérard.[3]

Foreign bodies derived from the lung.—According to their origin, the foreign bodies derived from the lungs may be divided into two very distinct categories: 1, those which are formed in the lungs; 2, those which, coming from without, enter the air-passages after having remained for a longer or shorter period in the pulmonary parenchyma. The first are, as a rule, composed of calcareous and phosphatic concretions and in part of organic matters which may develop in any portion of the respiratory tract, but preferably in the lungs and bronchi. It appears from Leroy's[4] work on this subject that these new formations, the volume of which never exceeds that of a large pea, are very rare, and are most frequently formed in tuberculous cavities. Under some exceptional circumstances these pneumophytes, which usually have no formed structure, present traces of organization, irregular osseous cells scattered through the mass of the concretion. In some rare cases the bronchial glands have been the centre of the production of these masses, and have made their way into the bronchi by ulceration. These general considerations will suffice to convey an idea of these concretions, which do not constitute true foreign bodies, but rather special products of the pulmonary parenchyma.

The second category, on the contrary, is very interesting, because it includes a group of foreign bodies which, being introduced into the lung by means of a wound or alteration of the thoracic walls, constitute one of the most curious and sometimes the most fortunate modes of termination of the presence of foreign bodies in wounds of the thorax. It is useless to enter in detail into these facts, which are not so marvellous as we have been led to believe. From the time of Fabrice de Hilden and Tulpius, up to the

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[1] Vigla: Archiv., 4e Série, T. XII.
[2] Jour. hebd., 1831, T. IV., p. 367.
[3] Thèse Paris, 1840: Des corporibus extraneis, etc.
[4] Leroy: Thèse Paris, 1868.

present time, a large number of cases of the escape of foreign bodies through the trachea has been observed. They include pieces of bone, clothing, bullets (Délius), irregular metallic fragments, such as the movement of a watch and pieces of glass. The reader will find sufficiently explicit considerations with regard to their enumeration and mode of introduction in the chapter on gunshot wounds.

CHAPTER IV.

NATURE OF THE SOLID FOREIGN BODIES.

The infinite variety of foreign bodies of the air-passages gives rise to some interesting considerations with regard to their nature, relative frequency, and properties.

In order to convey an idea of their character, I have collected in a table those which are most often observed, classifying them according to their origin, composition, and changeableness. In order to form this table, I have made use of Bourdillat's statistics, which include more than 300 cases, a number sufficiently large to enable us to draw some conclusions.

Foreign bodies of the respiratory passages.	Inanimate	Inorganic.	Solid.	Regular.	Beads of glass.
					Needles.
					Coins.
					Buttons.
					Bullets.
				Irregular.	Stones.
					Nails.
			Hollow.	.....	Rings of glass.
					Tracheotomy-tubes.
					Whistles.
					Mouthpieces.
					Pipe-bowl.
					Pierced fruit-pits, etc.
		Organic.	Solid.	Regular.	Beans.
					Nuts.
					Grains of corn, coffee, water-melons.—Date.
					Pills.—Peas.
				Irregular.	Pieces of nuts.
					Teeth.
					Bones.
					Fish-bones.
					Spikes.
					Pieces of meat.
					Food.
					Cork.
	Animate.	.....			Leeches.
					Worms.
					Flies.
					Hydatids.
					Oyster.
					Fish.

It is evident that in this classification the most important properties have served as the basis of division. I have thought it best to retain the

classical distinction of animate and inanimate bodies, although it presents no great importance, as the former are very rarely observed. The literature contains a certain number of examples of the introduction of worms into the air-passages, the majority of which have been collected in Aronssohn's thesis. Moreover, leeches have been swallowed with fluids, and have gradually entered the larynx. I have only been able to collect six authentic examples. Sennert reports that Pope Adrian IV. died in consequence of the introduction of a fly into the air-passages. Finally, Remy and Gautier have observed cases of the penetration of fish into the trachea.

Observation by Gautier.—Fish in the glottis.—Death.—On Aug. 12th, 1784, a farmer of Brandeau went to the sea with his domestics and day-laborers in order to fish. At the sixth dragging of the net he caught a small fish, which he seized with his teeth in order to hold it better. The fish became disengaged and suddenly glided into the larynx before the farmer could grasp it with his hand. The efforts of the man and of his companions were useless. Upon my arrival, I found the patient pulseless, motionless, cold, and expiring. I could only notice some slight convulsive movements in the muscles of the larynx. With the finger I came in contact with the tail of a fish, which projected three or four lines above the œsophagus. I attempted to extract the animal with the forceps, but I could only grasp a portion nine or ten lines long, which appeared to me to be a sea-loach. The administration of two grains of tartar emetic proved useless. The operation of bronchotomy was proposed, but was not permitted. The unfortunate patient died in less than two hours after the accident. The finger enabled me to assure myself that the fish was tightly engaged in the larynx. (Journal de médecine et de chirurgie, 1785, T. LXIV., p. 249.)

The author of this report adds that "the inhabitants of this region have the unfortunate habit of seizing with their teeth the small fish which they catch. Few years elapse without the occurrence of some accident similar to that which I have reported."

Wilkinson also reports, from information which appears worthy of credit, that a swallowed oyster and a fly (*musca vomitoria*) have caused death by entering the larynx.

The group of inanimate foreign bodies forms almost the totality of those found in the air-passages, and is divided into organic and inorganic objects. The former category includes the much larger number of cases, and may present an infinite variety, from small fruits and grains to débris of the trachea, cartilages, epiglottis, and even bronchial glands. Finally, the shape should play an important part in a classification of this kind, because this property is not indifferent from a pathological point of view. This is especially true of the tubular shape which has been sometimes observed.

Relative frequency.—Upon glancing over a collection of three or four hundred cases, like that made by Bourdillat, we are struck by the relative frequency of certain objects. Thus, among the three hundred cases collected by Bourdillat, in seventy-one the foreign body was a bean. This proportion (nearly a quarter) cannot be compared with that of any other object, and it is only with great difficulty that we have been able to collect thirty-six cases in which fruit-pits or pieces of them were introduced into the respiratory organs. The frequency with which beans are found in the hands of young children renders this peculiarity somewhat more comprehensible; but this does not suffice to explain the marked disproportion between these bodies and small pebbles, for instance. I will mention some figures which give an idea of the relative frequency of other objects. Shells or fruit-stones have been observed thirty-six times; pieces of bone in twenty cases; various grains, corn, coffee, melon, in fifteen cases. Fi-

nally, we must also mention, in the following order of frequency, vegetable spikes or spikelets, small pebbles, teeth, fish-bones, needles, nails, etc.

Form.—As regards shape, foreign bodies of the air-passages include three varieties, viz., regular, irregular, and hollow objects. The first are the most numerous; it will suffice to state that beans and a large number of grains form part of them. This condition greatly facilitates their introduction into the air-passages. Others are curious on account of their irregularity; and, in this respect, tufts of grasses offer some interesting peculiarities. In fact, when introduced in the direction of the beard, they penetrate very readily; but it is impossible to withdraw them in the same way, as it becomes imbedded in the mucous membrane. Some, like hooks, pins, needles, and fish-bones, present irregularities which render their movement more difficult. Some are flattened, and may occupy various positions, according as they are placed on edge or transversely in the canal. These include coins and all objects which are similar to them in shape. Finally, hollow bodies, although much less numerous, form a peculiar group, which presents interesting characteristics, because, when placed in the axis of the trachea, or of a bronchus, they do not prevent the passage of air. They include tracheotomy canulæ, rings, pipe-stems, a goose-quill, a reed, the mouthpiece of an instrument, etc.

Size.—The air-passages form a canal which is incapable of extension, and all bodies which penetrate it cannot surpass its internal dimensions. We must, however, make an exception in favor of the foreign bodies in the upper part of the larynx, which Laboulbène calls vestibular, and the very large size of which may prevent penetration. The latter may acquire very large dimensions, and the cases in which the bodies are large refer, for the most part, to pieces of meat swallowed by toothless old men whose mastication has become imperfect. The Receuils de médecine militaire[1] contain a case of death from a foreign body of the glottis in a man æt. eighty-four years. At the autopsy a piece of meat as large as a pigeon's egg was found in the larynx, entirely closing the opening of the glottis; a portion was even engaged in this opening. Millard also presented to the Anatomical Society (1859) a case in which the lower part of the pharynx and the opening of the larynx contained a piece of meat, irregularly trapezoidal in shape, its large vertical diameter measuring not less than 0.038–0.039m. The subject of this observation, a toothless, gluttonous old man, died immediately. I will have occasion to refer, at a later period, to facts of this kind.

As we descend in the air-passages, the foreign bodies which are encountered become smaller; this is readily understood, as the subdivision of the bronchi will prevent the passage of those which are larger. There is even a difference, in this regard, between the left and right bronchi in favor of the latter, a difference to which I shall soon return. Only extremely small bodies can pass through the terminations of the bronchi, and they are then included in the study of acquired phthisis.

Multiplicity.—While foreign bodies of the intestinal tract are often multiple, this is rarely observed, on the contrary, with regard to foreign bodies of the air-passages. This is explained by the intensity and rapidity of the symptoms which follow their introduction. However, a case has been reported in which two bodies have been expelled. These facts are not well authenticated, and it is not impossible that an accidental concretion was rendered movable by the presence of the foreign body. S.

[1] 1re. Série, T. XX.

Gross[1] states that two, three, and even four foreign substances have been known to enter simultaneously or successively. Royer Collard found several nails in the air-passages.

CHAPTER V.

THE SITUATION OF FOREIGN BODIES IN THE AIR-PASSAGES.

Foreign bodies may be found in all parts of the air-passages, but they also have certain points of election in which there are more chances of finding them than in others. Thus they are more frequently found in the right bronchus than the left, in the larynx than in the trachea. It is evident that we only refer to those which have a definite or permanent position. In fact, the mobile bodies are found sometimes in the larynx, sometimes in the bronchi, but most frequently in the trachea. Foreign bodies are divided, with regard to situation, into those found in the larynx, trachea, and bronchi.

1. Foreign Bodies of the Larynx.—There is a great difference, as regards the symptoms and treatment, between foreign bodies which occupy different parts of the larynx. While a body which is lodged in the ventricles may be tolerated for a long time, one which is situated, on the contrary, in the opening of the glottis causes immediate, sometimes terrible symptoms. We must therefore distinguish the foreign bodies as super-glottic, glottic, and sub-glottic. This old division, which has been adopted by Aronssohn and Guyon, corresponds to varieties observed in practice. Of late years, Laboulbène has thought that it would be advantageous to divide sub-glottic bodies into two groups, one vestibular, the other ventricular. The exact situation of the former is in the ary-epiglottic folds, that of the latter in the upper cavity of the glottis.

This subdivision, although a rational one, does not offer any great advantages, and does not correspond to sharply defined pathological varieties. Though it is true that large bodies, such as enormous pieces of meat referred to above, are vestibular rather than ventricular, we must remember that many of them enter more or less into the cavity, and are sometimes slightly ventricular, as in one of Prof. Perrin's cases. Furthermore, there are numerous examples in which the body occupies not alone the vestibule and the ventricle, but even the glottis. I will confine myself to quoting, as illustrations, Benoit's mouthpiece of a trumpet,[2] Vogel Vanger's[3] piece of carrot, Blandin's threaded needle, Perrin's piece of beef à-la-mode, Annandale's herring-bone, etc. It is evident, therefore, that this subdivision does not meet the demands of pathology.

Of all foreign bodies arrested in the larynx, the super-glottic ones are the most numerous. I have been able to collect more than twenty examples, almost all of which refer to large objects, such as marbles, pieces of meat, etc. Guyon states that they are found imbedded; but this is not always the case, as they have been known to be displaced by an effort of

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[1] Practical Treatise on Foreign Bodies in the Air-passages, 1854
[2] Gaz. méd. de Paris, 1846.
[3] Ibid., 1856

vomiting. Sometimes the bodies are small, like cherry-pits, and are very well tolerated.

The various authors are not in accord with regard to what is meant by glottic foreign bodies. Some understand, under the term glottis, the opening which separates the vocal cords, others the space which separates the two superior and inferior vocal cords. I share the views of the former, and believe that this variable orifice is rarely obstructed by a foreign body. If we examine the cases hitherto reported, we will soon recognize that true glottic bodies are incompatible with existence unless they are tubular or are placed on edge, if flattened. I know that examples of glottic foreign bodies have been found on autopsy; but, if we carefully examine the details of these cases, we will soon perceive that they only occupy this position in consequence of a sudden displacement, which is most often fatal.

Observation.—Almond-shell in the air-passages.—Death.—A child was run over by a wagon. After he had come to, he was carried to the hospital; the respiration was croupy. Forty-eight hours after the accident, upon raising him in order to make his bed, he was seized with a convulsive cough, threw his head back, and expired. The autopsy showed that the larynx contained a piece of almond shell, the edges of which were situated between the vocal cords in such a way that the lumen of the glottis was entirely closed. (Aronssohn: Thèse de Strasbourg, 1856, Ob. 22.)

In another case a shilling was thrown into the air and swallowed by a man. A short paroxysm of coughing and dyspnœa was produced; he went to a physician, complaining of a feeling of obstruction in the region of the cricoid cartilage. During a deep inspiration he experienced a clicking sensation; treatment by position proved successful. This case has been variously interpreted. According to some, it was an example of glottic foreign bodies, according to Laboulbène, of sub-glottic bodies; and usually it is regarded as ventricular. In fact, this object may have been situated in all three positions.[1] From the preceding statements we may conclude that glottic foreign bodies, properly speaking, are very rare. When they exist, they may occupy this position primarily, or they may arrive there later, after one or several paroxysms. Some cases demonstrate positively that the imbedding of fragments of bone or shells into the glottis occurred from below upward, after the body had escaped from the larynx and fallen into the trachea.

Sub-glottic foreign bodies, which are much less numerous, occupy the cricoid cartilage, and, as a rule, are not fixed to it. This does not happen until they have, for a longer or shorter period, been moved in the trachea during inspiration and expiration. Sometimes they are placed on edge, sometimes fixed at one point by one of their irregularities, so that they play the part of a valve and give rise, at the moment of entrance and exit of the air, to peculiar noises which are useful in diagnosis.

Situation of Foreign Bodies in the Trachea.—The situation occupied by foreign bodies in the trachea is very variable, as the large majority of bodies found here are movable in the current of air, and therefore occupy no fixed position. During the intervals of the paroxysms, they may temporarily assume a position of rest in the lowermost part, becoming adherent to the wall through the aid of frothy mucus. Those which are fixed in the trachea by their size or irregular form (pieces of meat, fish, pins, bone) keep the position in which they happened by chance to be arrested, without presenting any place of election.

[1] North Journal, 1845.

Situation of Foreign Bodies in the Bronchi.—The study of the situation of foreign bodies in the bronchi presents some interesting considerations. In fact, observation has enabled us to recognize that, in a third of the cases, the penetration has occurred in the left, and in the other two-thirds in the right bronchus. What are the reasons for this marked predisposition on the part of the right bronchus, which is almost a place of election?

Anatomy furnishes us with the solution of this question. In fact, we know for a long time that the volume of the right bronchus is greater than that of the left, and that this difference is due to the functional inequality of the lungs, as the left has one lobe less than the right. The dimensions of the right bronchus compared with those of the left are as follows: it measures 0.55–0.75 m. in length, 0.04 m. in breadth, and 0.035m. antero-posteriorly. The left bronchus measures 0.09 m. in length, 0.035 m. in breadth, and 0.03 m. antero-posteriorly. But this fact will not suffice to explain the much greater frequency with which small bodies, like beans, for example, are situated in the right bronchus, for, although we may admit that the larger bodies fall more readily into the larger tube, this question of calibre does not exist with regard to the smaller ones. To this reason, which is the one usually advanced, we must also add another, to which Goodall, of Dublin, has drawn attention. The rostrum which is found at the lower part of the trachea, at the point of division into the bronchi, is situated a little to the left of the median line. It therefore follows that if a solid body descends along the trachea by virtue of the laws of gravity, it will be directed toward the right bronchus. Finally, to these causes I will add the following one, which is due to the mechanism of introduction: the current of air is unequal in the two lungs, and the more intense aspiration on the right side exercises a greater effect upon the foreign body which is moved by the air.

After it has engaged in the bronchi, the foreign body penetrates as far as its size and shape permit. Those which are irregular may be placed transversely and may not pass beyond the primary division of the bronchi. Those which are soft and divisible, like particles of food, penetrate as far as the final ramifications.

In some cases the foreign body is arrested upon the rostrum which separates the origin of the two bronchi. Thus Oppolzer has seen a worm placed astraddle on this crest and give rise to symptoms with a fatal issue. Després quotes a case in which a piece of meat maintained this position for a long time. The possibility of such an occurrence is somewhat doubtful, because it is difficult to explain how a piece of meat, placed under conditions so eminently favorable to putrefaction, can remain for a long time in such an abnormal position without producing asphyxia or being expelled. Finally, Richet recently observed a piece of sponge in this situation.

CHAPTER VI.

MOBILITY AND FIXITY OF THE FOREIGN BODIES.

Before studying the mobility and fixity of the foreign bodies, we must distinguish an absolute and a relative mobility. Thus the mobility is absolute in those foreign bodies of the trachea which produce initial paroxysms, while it is relative when every movement of inspiration or expiration causes the body to vibrate in some part of the air-passages. This distinction being recognized, we can readily admit that all foreign bodies of the larynx are either fixed or enjoy a greater or less relative mobility. Some are so firmly imbedded that strong traction must be employed in order to detach them, and a foreign body which is somewhat thin may be broken under these attempts at traction (Mackenzie). I cannot convey a more correct idea of the resistance of this implantation than by recalling that Blandin, in a case in which a swallowed needle had been imbedded in the larynx, was unable to remove it, although he could grasp the thread which had been passed through the eye of the needle. In order to extract it he was compelled to incise the thyroid cartilage. On another occasion, a herring-bone was retained by its hook, and necessitated tracheotomy ; it also projected into the pharynx. In addition to these cases, there are others in which the foreign body, a cherry-pit, for example, forms a small niche in a ventricle, and thus encloses itself in the mucous membrane. Finally, I have already stated that sub-glottic foreign bodies present the peculiarity of remaining partially fixed while oscillating around a point of implantation. A large number of the pieces of nut-shells, nuts, almonds, fruit-pits, chestnuts, figs, metallic plates, etc., act in this manner, and, being fixed in this way, participate slightly in the movements of the current of air.

Fig. 26.—Obstruction of a child's trachea by a bean. (Museum of Val-de-Grâce.)

The type of absolute mobility is found realized in those foreign bodies of the trachea which are, for the most part, non-adherent to the walls. We must also refer to the small number of cases of fixity in the trachea ; these only include large or irregular bodies, such as food, bones, pins. The much smaller calibre of the trachea in the child renders this fixity more frequent in them. A large bean entirely occludes the trachea of a child, as is evident from the adjoining figure. In these cases there is no absolute mobility, but we often find relative mobility, either because the body, after having travelled for a long time from the bronchi to the larynx, is arrested at a certain point, or because the partial implantation permits certain quivering movements. The slightest influences may destroy this and replace it by absolute mobility. Thus it may suffice that the patient, whether standing or sitting, should lie down, or *vice versa*, in order that a body which is temporarily fixed should suddenly become movable. This event is followed, as we shall soon see, by a return of the symptoms. The foreign bodies, being thrown into motion by the air, ascend during expiration, and descend during inspiration. But

they do not all act in the same manner in the centre of the column of air. The very small ones do not touch the walls, while the very large ones are often thrown from one wall to the other.

Foreign bodies in the bronchi present numerous variations with regard to mobility and fixity; only absolute fixity and relative mobility are observed in these cases. At first the majority of the bodies which enter the bronchi are endowed with a certain mobility, with the exception of those whose shape and irregularity renders them fixed.

In fact, in a large number of cases of tracheotomy, the foreign bodies arrested in the bronchi are almost immediately ejected, an event which could not occur if they were fixed. But many of them, after having been readily movable for some time, become immovable at one point, either from the irritation and swelling which they produce, or from modifications of their own substance.

To this group belong dry seeds, which become swollen and are more fixed. Others, such as corn, have a characteristic migratory tendency, and very rapidly force their way to the bottom of the bronchial ramifications. Bégin has given to this class of bodies the appellation "*progressors.*" The primary or secondary fixity does not always persist indefinitely, for, as we shall hereafter see, the slow process which occurs around these bodies will succeed in disengaging them and rendering them more movable unless their properties have caused them to advance still farther, as we sometimes notice. A grain of corn has never been known to retrace its way, except in those rare cases in which it decomposes.

CHAPTER VII.

PRIMARY SYMPTOMS AND ACCIDENTS.

Whatever the situation occupied in the air-passages by the foreign body, and whether it is movable or not after its introduction, as soon as it enters the larynx and trachea it immediately produces a series of acute symptoms, whose onset is sudden, and the combination of which constitutes what is usually called a paroxysm of suffocation. But it is a mistake to believe that the symptoms occur in the same manner in all cases, and there are some exceptions to this general rule, as this *initial paroxysm* is sometimes wanting or the symptoms may not appear until a later period. Before entering upon the description of the characteristic group of primary symptoms, I will call attention to the striking analogy between the symptoms which accompany the arrest of a foreign body in the pharynx and œsophagus and those which are produced by introduction of the same body into the air-passages.

To this similarity of the primary symptoms must be attributed the uncertainty in which physicians, and much more the laity, are found when they are brought in contact with an accident of this kind.

Description of the Paroxysm of Initial Suffocation.—In the attacks of suffocation which accompany the penetration of the foreign body there are two phenomena which follow each other and may be frequently repeated. These are, on the one hand, the irritation produced by the

contact of an unusual substance with the tracheal or laryngeal mucous membrane, the sensibility of which is much less obtuse than has been believed for the past few years ; on the other hand, the reflex phenomena, the combination of which constitutes the means employed by nature in relieving the economy of an irritating body which is capable of compromising life. Although it is not always easy to determine the part belonging to one or the other category in the initial paroxysm, there are circumstances in which their succession is more sharply defined. Since inspiration is the rule in the cases of introduction into the larynx, the symptoms begin at a moment in which the air and the foreign body which it carries along with it enter the larynx. The sudden initial inspiration is followed by the irritation produced by the contact of the foreign body, the immediate effect of which is to produce occlusion of the glottis, as in every brusk and sudden effort. The expiratory muscles immediately begin to contract with extreme violence, and the column of air, either with or without the foreign body, is hurled against the glottis by the spasmodic contraction. Hence arise all the outward symptoms, among others the congestion of the face and neck, the violet color of the patients, who become turgid, at first red, and then cyanosed and blackish.

In a large number of observations, the authors refer to the same phenomenon by stating that at the moment of the accident suffocation occurs and the face becomes black. The eyes are fixed, injected, and protrude from the orbit. They express an intense degree of suffering, and manifest the anxiety of the patient, who is threatened with asphyxia. At the same time there are often unconscious and disordered convulsive movements ; the patients make signs which express their uneasiness and the necessity of prompt aid. The contraction of the muscles of expiration usually overcomes the spasm of the glottis, and cough is produced, at first composed of a single noisy expiration which produces slight relief, but which is soon arrested to reappear after a momentary cessation. The paroxysm is interrupted, very fatiguing, convulsive, and of variable duration, but does not usually exceed a few minutes.

Although the symptoms occur in this way in the majority of cases, there are others in which the initial paroxysm does not pass through all its phases, either because the complete asphyxia prevents nature from overcoming the obstacles which it encounters, as in cases of obstruction, for example, or because the intense irritation produces a persistent spasmodic condition of the glottis. According to these considerations, the initial paroxysm may terminate in death, in tolerance of the foreign body, or in its fixation at some part of the respiratory tract.

1. When death occurs during the initial paroxysm, it is either due to the fact that the passage of air is completely interrupted by the size of the foreign body itself, which can neither be displaced nor allow the air to pass, or to the excessive irritation which produces the spasm of the glottis. From one circumstance or another, the first expiration which follows the primary inspiration may not take place, and death may rapidly occur within a very few minutes.

This presents no analogy with strangulation, because at the autopsy, according to the surgeons who have written on this subject, and according to the observations which Prof. Perrin, physician-in-chief at Val-de-Grâce, has been pleased to communicate to me, we do not find the characteristic sub-pleural ecchymoses of ordinary mechanical asphyxia, and hardly any other lesion is present. Three of the pathological specimens in the Museum at Val-de-Grâce enable us to determine the disposition

of the foreign bodies in these interesting cases. Perhaps there is some unknown reflex action which explains the almost instantaneous death without the slightest convulsion. Moreover, the patients do not present the usual signs of asphyxia. They do not become cyanosed, the lips are not violet, and the injected eyes do not protrude from the orbit as in the ordinary initial paroxysm. Prof. Perrin insists strongly on these peculiarities, and they are also referred to by other authors. Thus, in a case reported by Whitcombe,[1] a piece of meat swallowed by an idiot produced a sudden fall, and the patient was apparently dead; *the face was cadaveric* and the lower jaw drooping. This group of phenomena gives to this class of accidents a peculiar appearance, which are also found in Porter's observations and in the following cases:

Observation by Perrin.—Alimentary bolus obstructing the trachea.—Sudden death.—An old man was quietly eating, when his attention was attracted by the arrival of a distinguished individual. He made a movement to turn around, and then suddenly fell; he merely made a few efforts at vomiting. Extraction was immediately attempted, but the foreign body was forced by the manipulations into the trachea. The patient came to, and was able to walk about twenty paces. He was made to drink, and could articulate a few words; he then fell again, and died.

At the autopsy an alimentary bolus was found in the trachea, moulded upon the lumen of this canal and descending to the bifurcation of the bronchi. (Obs. communicated by Prof. Perrin.)

Observation by Perrin.—Sudden death caused by the introduction of pancake into the trachea.—An old man, æt. 68 years, fell suddenly as if struck by lightning while leaving a café. At the autopsy an alimentary bolus was found, composed of pancake. The trachea was in a condition of chronic inflammation; no other pulmonary lesions. The foreign body filled the posterior pharyngeal cavity and extended forward to the orifice of the glottis. The epiglottis was raised.

Dupuytren's museum contains two curious specimens in which enormous objects have obstructed the larynx by lifting up the epiglottis. Death was equally sudden.

In the cases reported by Porter,[2] the foreign bodies were pieces of mutton, fat, beef. In one patient the trachea was filled with meat and vegetables. The foreign bodies found in the five observations of Perrin and Lüdger Lallemand had a similar origin; the obstruction was found to be produced by some hash, a piece of beefsteak, rolled pancake, and an alimentary bolus. Wilkinson[3] also reports that a man, æt. 30 years, who was eating in the house of a friend, rose for a moment as if about to vomit, and then fell dead after having walked a few steps. The autopsy showed that a piece of meat, weighing about twenty grammes, three inches long and an inch and a half wide, was fixed in the glottis. But there are some differences with regard to the conditions of production among the cases collected by various observers. Among Porter's seven fatal cases, the accident occurred six times in drunkards, while all the old people referred to in Perrin's observations died suddenly in full health and without any predisposing extrinsic cause. In only one case did Porter observe sudden death (in two minutes), although this is the rule in old persons. I have called attention elsewhere to the evident influence which changes in the glottis exert upon the abnormal introduction of foreign bodies into the air-passages. In old persons, modification of the fibro-cartilage have been observed on several occasions, with

[1] Journal of Mental Sciences, XXII., 1876. [2] Dublin Med. Press, 1859. [3] Ibid.

loss of elasticity, partial ossification, and enlargement of the opening of the glottis, so that the epiglottis could no longer cover it, as in the preceding observation. In explaining this penetration we must also take into consideration the diminution in the sensibility of the region and the paresis of the muscles which assist in deglutition, thus giving rise to a want of harmony in the execution of the complex movements of this function. Whatever may be the explanation, these examples, to which many others might be added, are interesting, and I think it will be useful to add the following, which are derived from the same source and were observed under analogous conditions :

Observation by Lüdger Lallemand.—Sudden death from the introduction of hash into the trachea.—An old officer was quietly eating at his bedside when his neighbor saw him fall suddenly upon the edge of the bed, without any cries, any expulsive efforts, or signs of suffocation. He was hastily raised, but gave no signs of life. The physician on duty, being immediately summoned, arrived at the end of a few minutes, but found the man dead, and despite his efforts was unable to resuscitate him.

Autopsy.—A long roll of hash was found in the lower end of the trachea, entirely filling its lumen and descending to the bifurcation of the bronchi. Examination of the other organs showed no changes peculiar to asphyxia. (Communicated by Perrin.)

Observation by Perrin.—Obstruction of the glottis and trachea by a piece of meat.—Sudden death.—An old man, æt. 82 years, in good health and having nearly all his teeth, made two or three attempts at regurgitation while quietly eating, gave a slight peculiar cry, then fell down without showing any signs of life. Medical aid did not arrive until long after, but the data furnished by the relatives are decisive. He fell down as if struck by lightning.

Autopsy (24 hours after death).—External appearances normal ; face tranquil, discolored ; head normal. An alimentary bolus, 7 centimetres long, was found in the air-passages. This bolus, composed of a piece of beefsteak, completely filled the larynx, in which it was firmly enclosed. The upper extremity protruded 12 millimetres from the upper opening of the glottis, the lower end terminated in a point which reached to the third ring of the trachea. The larynx was widely opened above ; the opening of the glottis represented a large oval orifice, shaped like the tip of a flute, and was only incompletely closed by the epiglottis after the latter was lowered by the finger. It appeared to be about one centimetre too short. The epiglottis was very flexible. The arytenoid cartilages were kept at their maximum of separation by the foreign body. The trachea and bronchi presented a brownish red coloration ; they were covered with thick mucus, a fact which confirms the data with regard to the habitual good health of the patient. No ecchymoses on the surface of the lung, no hemorrhagic suffusion in the bronchi. Wonderful to relate, there was no emphysema ; slight hypostasis posteriorly. Left heart empty, right heart contained 100 grammes of fluid blood.

Observation by Perrin.—Entrance of an alimentary bolus into the air-passages.—Sudden death.—An invalid, 62 years old, suddenly fell, in the midst of a meal, consisting of beef, without any reaction, and without any expulsive efforts or distress ; complete resolution. The man fell on his neighbor's knees, immovable and inert, with the exception of a few slight spasms in the arms and some groans. The physician on duty was immediately called, but found him dead. The patient was very quiet at the moment of the accident, and had not spoken, laughed, or coughed. There was nothing to explain the entrance of a foreign body into the air-passages.

Autopsy.—Epiglottis rigid and raised, larynx empty and healthy. A movable alimentary mass, as large as a hazel-nut, was present at the base of the larynx and in the glosso-epiglottic fossa. At the height of the fifth ring of the trachea the lumen of the organ was obstructed by a cylindrical alimentary bolus, 6 centimetres long, the lower extremity of which touched the tracheal septum.

The lungs were healthy, with the exception of slight passive hyperæmia posteriorly ; the cavities of the left heart were empty, and those of the right heart and the venæ cavæ only contained a few spoonfuls of slightly fluid blood. No ecchymoses in the lungs or trachea. The face was natural ; the jaw was provided with sufficient teeth for the purposes of mastication.

2. When death does not occur, the initial paroxysm may terminate by the spontaneous expulsion of the foreign body, and after this has happened, the terrible primary symptoms gradually decrease.

3. The initial paroxysm may be prolonged for a longer or shorter period, when the foreign body remains movable in the air-passages. It is then composed of an intermittent series of small paroxysms, during which the irritation produces cough, which is incapable of expelling the irritating body.

4. The initial paroxysm very often terminates, after having lasted for some time, by the fixation of the foreign body at some point in the larynx, trachea, or bronchi.

Of these four methods of the termination of the initial paroxysm, two alone will be considered in this chapter, viz., the persistence of the mobility, and hence the continuance of the symptoms ; on the other hand,

FIG. 27.

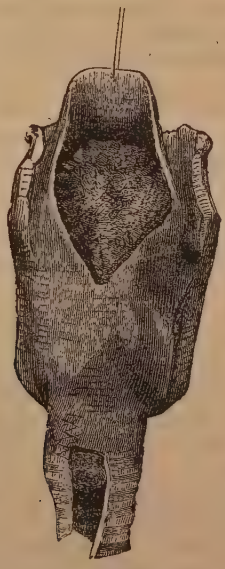

FIG. 28.

Specimens of obstruction of the trachea by alimentary substances (pancake, piece of boiled beef). (Specimens deposited in Museum of Val-de-Grâce by Dr. Maurice Perrin.)

fixation at one part of the canal and the series of varied symptoms which usually result therefrom. I will have occasion to return to the other two in discussing the various terminations of the accidents produced by the presence of foreign bodies in the air-passages.

Accidents produced by the presence of a movable foreign body.—As I have shown above, a foreign body must fulfil a certain number of conditions in order that it remain movable in the air-passages. It must not be too large and must not immediately endanger life by producing asphyxia from occlusion of the trachea. In addition, the contraction of the expiratory muscles must be sufficiently strong to overcome the resistance of the glottis.

In the case with which we are now occupied, the initial paroxysm may be as severe as usual, but it is characterized, on the one hand, by its long

duration, and, on the other, by its relapses. If the foreign body were displaced at each movement of inspiration or expiration (this is, however, impossible), the paroxysm would be prolonged indefinitely, and would undoubtedly terminate in asphyxia. But affairs do not, in reality, occur in this manner, and, after several paroxysms of suffocation, periods of rest occur during which the foreign body remains fixed at one part of the wall of the bronchi. The symptoms are not reproduced until, after a movement of deglutition, vomiting, an effort of inspiration or expiration, and in consequence of the prolonged irritation, the body leaves the place, which it has temporarily occupied, to again follow the current of air; this hurls it against the closed glottis, whence it is drawn, by an active inspiration, into the trachea and bronchi. The standing or recumbent position plays an analogous part.

The appearance of the patient differs altogether, according as we regard him in a moment of rest or during a paroxysm. The calm of the one contrasts with the grave symptoms of the other, which resemble the initial paroxysm in all respects. It is unnecessary to refer to the external signs mentioned above; we may, however, add a few others, to which I will now call attention.

Thus the hoarse, convulsive cough greatly fatigues the patient; one paroxysm has hardly ceased before another follows, caused by the irritation of the mucous membrane and especially of the larynx. According to Després these symptoms are more severe and persistent when the patients are lying down than when they are standing. They terminate in the expectoration of a small amount of sometimes sanguinolent mucus, although this is not observed in all cases and its expulsion produces no relief.

One of the symptoms, which is very often observed in cases of movable foreign bodies in the trachea, is the chattering noise (synonym : *bruit of the flapping sail, bruit of the standard*), to which Dupuytren has attached his name, although it had been known for a long time and was especially mentioned by Zwinger.[1] This sound is produced during expiration or inspiration, and it appears to be due to the rubbing of the foreign body against the walls of the trachea ; but it must be remembered that the small size and shape are not indifferent factors in its production. It is sometimes loud, and may be heard at a distance by the patient or surrounding persons, sometimes, on the contrary (this is much more common), it is much less intense, and the ear or stethoscope must be applied to the trachea in order to detect it. The view, that this sound is caused by the friction of the foreign body against the walls of the canal, is sustained by the fact that, when the hand is applied to the neck, a slight characteristic vibration is felt, to the diagnostic value of which Dupuytren has justly called attention.

We must not confound with this sign (which is pathognomonic of movable foreign bodies) the laryngeal clicking bruit produced by the oscillations of a foreign body arrested in the larynx, and which is alternately raised and lowered with inspiration or expiration.

The patient feels the movements of the foreign body, to a certain extent, and this sign may serve, in some cases, to put us on the track of the diagnosis. Thus cases have occurred in which errors have been long committed by physicians who paid no attention to the precise data furnished by the patients. In the classical example of the engineer Brunel,

[1] Acta Helvetia, Basil, 1751, p. 43.

the half-sovereign which he had swallowed was very distinctly felt by him when it moved in the trachea, and this information enabled B. Brodie to diagnose the presence of the foreign body.

Auscultation during the paroxysm does not furnish characteristic signs; it only enables us to hear the bruits produced in the trachea, and to which we referred above. We also notice that the breathing is very rapid and that it does not present a regular rhythm. Denucé, of Bordeaux,[1] has more recently observed a depression of temperature.

When the paroxysm has subsided, quiet ensues, and the patient experiences great improvement. The sensation of the foreign body sometimes remains, and usually consists of a diffuse pain, which is sometimes confined to the point at which it is temporarily arrested. There may also be slight oppression, dyspnœa, feeble voice, but these symptoms vary greatly, as we can readily understand, because during these intervals of repose the phenomena change according as the foreign body becomes fixed in the ventricle of the larynx, in the bronchi, or in the trachea. The cough very frequently persists with less intensity than during the paroxysms, and the expectoration is somewhat more abundant, is always frothy, and is streaked with blood, or rose-colored.

Symptoms and Accidents produced by Foreign Bodies fixed in the Larynx.—The larynx may be the seat of foreign bodies, and these may be situated in various positions; some are lodged, as we have seen, in the ventricles, others occupy the glottic or ventricular orifice.

If we look at them from another point of view, some are fixed immediately at the moment of introduction, while others only become lodged, after they have been present for a longer or shorter period, in the bronchi or trachea. Two facts predominate in the history of bodies fixed in the larynx: either they are tolerated when they do not cause any very considerable obstruction to the passage of air (if they are tubular or are placed on edge), or they occupy, and more or less completely close, the orifice of the glottis; death then usually occurs within a short period.

Examples of death from immediate asphyxia are not rare, and this mode of termination of the initial paroxysm will occur with greater probability the larger the body is and the more readily it can be pushed inward, as, for example, a coin between the lips of the glottis. These are especially examples of supra-glottic position.

But obstruction of the larynx may occur from another mechanism, and death occurs when a foreign body, which has come from the trachea or bronchi, becomes fixed in the lower part of the glottis and produces asphyxia. While, in the previous case, death was due to the initial paroxysm, in the latter it is produced during a later attack. The importance of this fact is evident to every one, because surgical interference may be attended with successful results in the latter case, while there is not sufficient time for action in the first case, as death occurs with lightning-like rapidity.

When they are tolerated, laryngeal foreign bodies, whatever their origin, may give rise to a certain number of phenomena, such as functional disorders, subjective and objective signs, the knowledge of which is of the highest interest to the surgeon. All of them have great diagnostic value.

In order that they may be tolerated for any length of time without producing asphyxia, laryngeal foreign bodies must fulfil a certain number of

[1] Société de chirurgie, 1871.

indispensable conditions. The first and most important of all is the persistence of the passage of air through the glottis. This obtains, in some cases, when the foreign body is sufficiently small to be lodged in the cavity of the ventricle of the larynx ; when it is narrow, placed on edge, and divides the opening of the glottis into two parts, or, furthermore (and this is much rarer), when the body is tubular in shape and the central cavity allows the passage of air. In addition, the spasm of the glottis must not be excessive, and the pain caused by the irritation must not continue for too long a period. In these cases alone death does not occur immediately, and a longer or shorter remission occurs, which gives place to a variable tolerance, which is always more apparent than real, or to the production of severe accidents, which may threaten life. A slight accidental displacement will suffice to cause a body, which was situated on edge, to bend over and be placed on its face, to cause a cherry, which was lodged in the ventricle of Morgagni, to fall into the trachea, etc.

Nor is there any certainty that a body arrested in the larynx will not produce any accidents, and this fact assumes great importance both with regard to prognosis and treatment. Even in cases of partial fixation, the surgeon should not forget that, in the progress of the disease, a foreign body, which is well tolerated, may become movable at any moment, and produce the most severe accidents.

The signs which usually accompany the presence of foreign bodies in the larynx are very slightly characteristic. In fact, according as the asphyxia is immediate or not, the symptoms do not differ very much from those of other parts of the air-passages. A person swallows a large piece of meat, which falls into the supra-glottic vestibule. Nothing in the course of the grave symptoms will enable us to distinguish the situation of the foreign body, because it may lead to the same results in the trachea. However, some signs of the period of tolerance, when all or only a part of them are observed, have a real value, and enable us to localize the point at which the irritating body is situated.

Pain is one of the most constant symptoms. It rarely passes unmentioned, as it is continuous, and presents exacerbations whenever the larynx performs its functions, either during deglutition or speech. Furthermore, it is localized, and the patients usually indicate with the finger the exact point in which they feel the pain and at which they suppose the foreign body to be. It is due to the great irritation which its presence always produces; an ulceration is also present at times, whenever some irregularity has wounded the tissues and has become fixed.

The same cause also gives rise to a very frequent laryngeal, distressing, irresistible, convulsive cough, which fatigues the patient exceedingly, and which usually terminates in the expectoration of some tracheal mucus, rarely streaked with blood. It soon produces dyspnœa and oppression.

To these subjective signs we must also add the sensation experienced by the patients, which, in addition to the pain, permits them to define the situation of the foreign body. It is present more rarely than in those which are movable in the trachea.

Their presence in the larynx is very frequently manifested by local and general functional disorders. It is unnecessary to insist upon the dysphagia and interference with hæmatosis, to which this accident always gives rise. But the partial or total aphonia is a symptom of great importance, which is not observed to the same extent when the body occupies another position. The aphonia is very rarely complete, and, as a rule,

there is merely some alteration in the timbre, intensity, and pitch of the voice, which becomes hoarse and interrupted. The only physical signs which enable us to affirm the existence of a foreign body in the larynx are the clicking noise and laryngoscopical examination. The clicking bruit is usually produced when a flattened object, such as an egg-shell, which was at first lodged in the trachea, has become lodged, during an expulsive effort, in the sub-glottic space, where it is more or less firmly fixed. Whenever air is introduced into the lung or emerges from it, there is a slight movement of the body upon one axis, and this displacement is made evident externally by a slight, irregular, intermittent bruit, isochronous with respiration, and which is also perceived by the patient. Duncan has reported a remarkable example, but the sign is rare. The perception of the foreign body with the laryngoscope, or with the finger introduced deep into the larynx, is much more valuable. I will have occasion to refer to these facts with more detail in discussing the diagnosis.

I have designedly passed by in silence the symptoms peculiar to leeches, which here, as everywhere else, produce very obstinate and dangerous hemorrhages, as much by their persistence as by their situation. In fact, the leech, by swelling, irritates the larynx, obstructs the entrance of air, and the blood, which slowly flows, produces dyspnœa, cough, a pricking sensation, and a very distressing and obscure occlusion, which is so much greater as the patients have no idea of the real cause of their sufferings. But the development of hemorrhagic expectoration, in the midst of perfect health, in an individual who does not cough, and experiences an obstruction in the larynx, is a characteristic symptom of the presence of a leech in the air-passages.

In all the preceding cases we have only referred to irregular, irritating, fixed bodies, the effects of which are confined to certain parts of the larynx, without completely intercepting the passage of air.

What happens if the foreign body is regular and tubular, like a catheter? Experience has long since settled this question, for laryngeal catheterism has been proposed under some circumstances since the most remote antiquity.

At other times a surgeon, while endeavoring to sound the œsophagus, follows the wrong path, and enters the larynx. During recent times laryngeal catheterism of the ancients was restored to honor by Bouchut, abandoned again, and finally readopted. Finally, we cannot deny that a hollow body, such as a whistle, the claw of a lobster, or a mouthpiece, may be arrested in the larynx. It has been remarked that, contrary to what usually occurs, these bodies are well tolerated, and do not produce very serious, immediate, or secondary results. These tubes only modify the ordinary conditions of respiration to a slight extent, as they do not oppose the passage of air, and, on occount of their regular action upon the glottis, are less dangerous and irritating, so that the spasm is not produced with the same intensity.

Considerable discussion has taken place in order to determine whether, in these exceptional cases, cough is produced or not. At a meeting of the Académie de médecine,[1] Gerdy, who regarded convulsive cough as a characteristic sign of laryngeal foreign bodies, was opposed by Bérard, who had observed some cases in which it had not taken place. If we restrict the question of cough to these cases of hollow bodies alone, it is evident that Bérard is right, because, in order that cough should be pro-

[1] Acad. de méd., Dec. 7, 1841.

duced, momentary occlusion of the glottis must occur, an event which is impossible on account of the presence of the tube.

But Bérard was not right, except under the condition that the tube was large, nearly the size of the natural opening. If this is not the case, the passage of air is not assured, the symptoms of asphyxia soon appear, a convulsive expiration may deceive us, and make us believe in the presence of paroxysms of cough, which are more apparent than real. Moreover, laryngeal catheterism, which is performed every day with Chaussier's tube, is a proof of the tolerance of the larynx for this class of foreign bodies.

Symptoms and Accidents produced by Foreign Bodies fixed in the Trachea and Bronchi.—I will briefly recall the conditions under which a foreign body may be fixed in the trachea or bronchi. These bodies have usually come from the outside, and, after having been movable for a few minutes in the trachea, finally become fixed. Or, perhaps, their fixation has occurred primarily, either because, as in Suë's[1] case, a foreign body was implanted in the trachea from without inward, or because it has at once penetrated this organ without being arrested in the larynx. Not alone small bodies can thus enter the larynx without difficulty, for Pératé has reported a case in which a large piece of meat had fallen into the trachea, and in another, published by Remy,[2] a small fish, 0.07 m. long and 0.02 m. broad, was introduced as far as the lower part of the trachea, and caused death. Campbell, Porter, Perrin, Whitcombe, etc., have observed similar cases.

To these causes must also be added some others, in which the path of introduction was made by the operation for tracheotomy, and the foreign body was a portion of the canula.

Here, as in the other bodies of the air-passages, the series of accidents always begins by an initial paroxysm, the extremely variable intensity of which may produce the gravest as well as the slightest symptoms. With regard to the primary evolution and the symptoms, these cases may be divided into three varieties, according as: 1, the foreign bodies are large and solid; 2, small and solid; 3, tubular. Until recent times only the first two varieties were recognized, and it is due to the experience of the last ten years that we can study the third variety separately.

1. *Large, solid bodies.*—We understand by large bodies all those which, like fish (Remy), pieces of meat (Pératé, Perrin, Porter, etc.), almonds, nut-shells, etc., are not capable of being forced far into the trachea, and especially into the bronchi, on account of their diameter. As soon as they become fixed, they produce great difficulty in respiration, and whether this occurs primarily at the end of an initial paroxysm, or as the termination of a movable body, they all follow the same course, which may be summed up in two words: obstruction and asphyxia. But large bodies deviate from this rule and do not produce severe symptoms in all positions. These include flat bodies, such as coins, which may either obstruct the lumen of the canal or only partially interfere with the passage of air, when they are placed on edge. While they act, in the second case, like hollow or tubular objects, they have the effect of large, solid bodies in the first case.

The obstruction is sometimes complete and confined to the trachea. The introduction of air then becomes absolutely impossible. Expiration

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[1] Ac. de chirurgie, T. XIV., in-12.

[2] Ann. de la chirurgie, française et étrangère, T. VII., p. 356, 1842.

is very difficult, and death by asphyxia is the fatal, primary termination, manifested to the physician by the entire known group of symptoms of acute asphyxia. When it is confined to a large bronchus, or when the partial obstruction of the trachea still permits a slight passage of air, the symptoms do not develop with the same rapidity. The continuance of life is still possible for some time, but it is soon endangered by the unequal struggle between the necessity of hæmatosis and the impossibility of the introduction of air. Sometimes only one large bronchus is obstructed, and the symptoms do not transpire in the same manner, according as one or the other is the site of the foreign body.

This is a question of calibre, and on this account the bodies which obstruct the right bronchus are much more dangerous than those obstructing its fellow, because they compromise respiration over a much larger pulmonary area, and their presence becomes even more incompatible with existence. The subjective or objective symptoms which exist during this period of increasing agony are the same as those of the smaller bodies, which will be discussed at a later period, and to which I refer the reader. In concluding this description of the symptoms produced by solid large bodies, we must add that the supplementary action of one of the lungs, in order to remedy the suppression of the functions of the other, is never sufficiently great to prolong life, as the obstruction of a large bronchus produces too serious disorders.

2. *Small, solid foreign bodies.*—The chief place in this class is occupied by beans, which are by far the most frequent, then by grains, fruit-pits, etc. These bodies usually become fixed in a bronchial division of the second order, and only intercept the passage of air to a group of lobules, sometimes to one or two lobes of the lung. They may be regarded as the type of foreign bodies in the bronchi and lungs, and it it is for this reason that I describe the various symptoms by which they manifest their presence. I should first state that they do not compromise life to the same degree as the preceding ones, and that when death occurs, it results much less frequently from asphyxia, as we shall see later, than from the complications to which they give rise.

The symptoms of the foreign bodies fixed in the bronchi and lungs are subjective, functional, and objective. But they do not, by any means, have the same importance, and are not found combined in all patients.

1. *Subjective symptoms.*—Pain is not always present, as the secondary symptoms sometimes occur in persons who have never experienced any, and who are even ignorant of the time of introduction. When it appears, it presents well-marked characteristics ; it is always limited to one part of the chest, either on the left or right side, is persistent, and increases in certain positions of the body and during coughing. It is never very acute, usually remains dull and throbbing, and is one of the symptoms from which the patients suffer most.

We not infrequently find it disappear after a few days, either because the foreign body is expelled, or because the later complications have changed its condition of fixation.

The patient does not experience the feeling of a foreign body, and this pain is the only factor to guide him in determining the situation of his malady.

2. *Functional symptoms.*—The functional symptoms which accompany the presence of foreign bodies in the bronchi and lung result, on the one hand, from the irritation which they produce, and, on the other,

from the disturbance of respiration and hæmatosis caused by the suppression of the function of a portion of the lung. The patients experience a hindrance in respiration, they cannot take a full breath at will, and they feel the necessity of breathing, a function which is usually performed unconsciously.

If a somewhat larger bronchus is obstructed, the dyspnœa increases, and the number of respirations may soon be doubled. The patient feels oppressed, and seeks a position which will permit him to breathe more readily. This is most often effected by lying upon the side which is the seat of the obstruction in such a manner as undoubtedly to favor the greater dilatation of the other lung. If the equilibrium between the necessity of hæmatosis and the quantity of air which penetrates the lung can be obtained, the functional disorders may remain very slight. As soon as this equilibrium is disturbed, the patients gradually advance toward slow asphyxia, which is manifested by cyanosis and suffocation.

3. *Objective symptoms.*—Though the preceding symptoms present nothing characteristic, this is not true of the objective signs, some of which are pathognomonic. The cough is less violent than in the preceding cases, but it is rarely absent. Furthermore, it is persistent, or barely subsides before it begins again. It is caused by the irritation produced by the contact of the foreign body with the bronchial mucous membrane, and greatly resembles the cough of bronchitis. The cough almost always terminates in the expulsion of a certain quantity of frothy, slightly sanguinolent mucus; at other times it is glairy. These phenomena are only observed in the beginning, as a reaction ensues upon the second or third day which almost always produces bronchitis. The discharge of blood is much more marked under some circumstances. Lenglet's case is an illustration of this primary hæmoptysis.

Observation.—Hæmoptysis caused by a piece of bone.—Spontaneous expulsion.—Death.—A soldier of the Piémont regiment (infantry), garrisoned at Briançon, was acting as cook, and after having apportioned the meat for those who constituted the mess, began to suck a marrow-bone. He was immediately tormented by a violent cough, and pains were felt in the left side of the chest with spitting of blood. He was taken to the hospital, where he was bled several times and treated for pleurisy. After a certain lapse of time he rejoined his regiment at Sedan, in the month of March, 1758, having made the journey in a very rigorous season. He returned to the military hospital on the 22d, complaining of a great difficulty of respiration. He expectorated an abundance of pus in very frequent paroxysms of cough; the pus was of an ashen color and of a very fetid odor. Milk and water in an infusion of ground ivy was prescribed, but its continued use was prevented by diarrhœa. Various anodyne narcotics were administered to relieve the cough, but without success. Finally, on the 29th of April, the patient had a long and terrible paroxysm of cough, during which he expelled, with great difficulty and incredible efforts, a piece of bone of a triangular figure, having very sharp angles and cutting borders; one side was nine lines long. From this time on the patient no longer felt any pain in the chest. Respiration was undisturbed; he coughed but little and without difficulty; expectoration was performed with readiness. Despite these favorable symptoms, the disease terminated in death three days after the event which had appeared so fortunate.

At the autopsy the right lung was found in a normal condition; the left lung was gangrenous. Lenglet opened the trachea along its whole length as far as the bronchi, where he found, about four inches below the bifurcation on the left side, an abnormal cavity capable of containing a large nutmeg. The foreign body had remained in this cavity for a space of ten months. The painful point had, from the very beginning, indicated the region to which the foreign body had been primarily carried. (Mém. de l'Acad. royale de chir., T. XIV, in-12, p. 441.)

The most important symptoms are furnished by percussion and auscultation, and their study is of the greatest importance with regard to diag-

nosis. When we percuss the lung on the side on which the foreign body is situated, the normal resonance is observed throughout the whole extent of the lung, and it is very difficult to discover even a slight difference between the two sides of the thorax. Nevertheless it has sometimes been observed, and this fact has been known for a long time; Jobert has explained it by the supplementary functional action of the other lung.

In the first place, we may ask, what is the value of a negative sign such as that which is furnished by percussion? In order to make it valuable, we must supplement the resonance by the data furnished by auscultation.

The ear, when applied to the posterior part of the chest, detects a marked difference between the two lungs, and even between different portions of the same lung. While the vesicular murmur is heard very distinctly on the sound side, it has entirely disappeared throughout a part or the whole extent of the other lung, and this condition persists during inspiration as well as expiration. These two phenomena, the persistence of resonance and the absence of vesicular murmur, are entirely characteristic and are peculiar to the arrest of a foreign body in a bronchial division. Sometimes the air does not enter one lobe (very often the upper), sometimes two lobes, and more rarely the entire lung.

In order that these signs should be distinct, the obstruction of the bronchus or trachea must be complete, as happens in cases of the entrance of beans, which, by becoming swollen, entirely obstruct the lumen of the canal. But this does not always occur, either because the foreign body only obstructs a part of the canal, and allows, to a slight extent, the passage of air into the corresponding lobe of the lung, or because it is placed on edge, as may happen when the object is small and flattened. In such cases the vesicular murmur is not entirely wanting, as had been observed by Hamburger, but is markedly diminished when compared with the opposite side. In addition, it is not rare to observe a peculiar bruit which proceeds from the vibrations of the foreign body on account of the division of the current of air upon it or from the vibration of the adherent mucus. This phenomenon is known as the stridulous bruit, and is an excellent sign when present; it is noticed at a distance as well as upon auscultation of the chest.

From the preceding remarks it is evident that a small and fixed body in the trachea may not give rise to any stethoscopic sign, and B. Brodie, not knowing all the conditions of the problem, regarded auscultation as a useless measure. "Hodgson, of Birmingham," he says, "has communicated to me the history of a case which he observed, in which the seed of a plant called bladder senna, of the size of a large pea, had entered the trachea of a child six years old. Repeated examinations with the stethoscope revealed nothing abnormal in the condition of respiration. Nevertheless the child suddenly died, on the 7th day after the accident, and, at the autopsy, the seed was found lodged in the trachea about an inch below the cricoid cartilage."

In another case, occurring in a little girl two years old, a physician, who was very familiar with the use of the stethoscope, carefully examined the chest with this instrument on several occasions, and was unable to discover any peculiarity in respiration. The autopsy, however, revealed the presence of a lobster's claw, which was solidly fixed in the trachea a little above the level of the upper border of the sternum.

Practice is in entire accord with the theory, and it would be surprising that a foreign body fixed in the trachea should give rise to stetho-

scopic signs, since it does not interfere very markedly with the entrance of air into the bronchi, and certainly not more with regard to one lung than the other. Auscultation is, therefore, not open to the reproach made by Brodie.[1]

These are the objective symptoms furnished by an examination of the patient. We will also add that there is no fever in the beginning, but the pulse is, nevertheless, very often accelerated.

4. *Tubular foreign bodies.*—I have already had occasion to draw attention to this group of foreign bodies, and their history is especially interesting with regard to the symptomatology. In the first place, it is evident that they allow a certain quantity of air to pass through their lumen, and that this quantity will increase with the calibre of the tube. We can therefore readily grasp the differences between a piece of pipe-stem, a small whistle, and a tracheotomy canula, as the first are very similar to solid bodies, while the latter differs markedly from them. The symptoms increase in intensity in an inverse proportion to the calibre of the tube. The larger the calibre, the less marked the symptoms; they become more severe, on the contrary, when it is small. If we wish to form an idea of the mild character and benignity of the symptoms in cases of large tubular foreign bodies, we need only refer to the observations of Clément Lucas.[2]

Observation.—Fall of a tracheotomy tube into the bronchi.—Very slight symptoms.—A man wished to replace the inner tube of his canula, which he had removed in order to cleanse it. The outer tube became detached from the plate and was introduced into the trachea. This was followed by a violent spell of coughing, which soon subsided. He sought aid in a city hospital, and was admitted; but it appears that his story of the accident was not believed, so slight were the symptoms.

A tube of this kind may merely produce a painful sensation in the region of the sternum and on the right side, and, at other times, a very harsh and disturbed respiration. What a difference between this mild group of symptoms and those produced by solid bodies! If we examine the chest, resonance is found to persist and the vesicular murmur is very slightly or not at all interfered with, as the air can pass into the alveoli. If, however, we pass to cases of tubular bodies of small calibre, the results are no longer so simple, and the symptoms are much more marked.

They are intermediate between solid foreign bodies and the preceding ones. There is not complete absence of the vesicular murmur, but merely a diminution, as in certain cases of bronchitis, with persistence of resonance. A characteristic phenomenon is the production of a sibilant bruit from the passage of the air through the tube. If the foreign body is a whistle, we may even hear the noise produced by this instrument. The following observations are very curious and instructive from this point of view:

Observation.—Perforated foreign body.—Peculiar symptoms.—Whistling sound (Smith: Lancet, 1876).—A child, six years old, while walking swallowed a whistle which he had in his mouth. This object was as thick as a pen-holder and about an inch and a half long. At the time in which he swallowed it, he was holding it between his lips blowing air through it in order to produce a sound. Two hours after the accident, a whistling noise was heard whenever he breathed. The child was frightened, but did not appear to suffer or have any dyspnœa. The whistling ceased as an emetic was about to be administered. A purgative did not succeed in causing the discharge of

[1] Médico-chirurgical Trans., 2d Series, Vol. VIII.
[2] Ibid., Vol. LX., p. 99, 1877.

the whistle, and not much attention was paid to the case, the child not appearing to be distressed. Some weeks afterward the whistling was again heard at intervals. He began to have frequent paroxysms of croupy respiration with some expectoration. He did not suffer, and was not very much annoyed by it. Nothing could be felt or seen in the pharynx and no dulness was detected on percussing the chest. The right lung was not dilated as freely as the left; it presented an almost complete absence of the respiratory murmur, and the voice sounds could not be heard over the lower portion of the right lung, while the normal respiratory murmur was heard at the apex of the same lung. Puerile respiration throughout the entire left lung. The treatment recommended was inversion of the body. Preparations were made to perform tracheotomy if this should become necessary. At a consultation, held two days later, and in which Teale took part, the same physical signs were observed, and laryngoscopic examination showed that the foreign body was not in the trachea or larynx. Finding that only a portion of the right lung was deprived of air, that the obstruction was beyond the range of instruments of extraction, and considering, on the other hand, the absence of all urgent symptoms, it was decided to make efforts to dislodge the whistle. The attempt failed, and quiet and repose were recommended.

The whistling reappeared a few days later; it was only produced during cough and deep expiration. It was heard with difficulty by the aid of the stethoscope applied to the chest; it conveyed the same impression as when the noise is made by the mouth. From this period until the month of May, that is to say, for three months, the whistling appeared from time to time, and sometimes at intervals of a few days. He had more or less cough, and emaciated, so that cod-liver oil was administered. About this time he had a very profuse expectoration, and, after having vomited a large quantity of mucus, the cough became also continuous until the whistle was expelled during a violent attack of suffocation. Rapid recovery.

Observation.—Case of a hollow foreign body (pipe-stem).—Extraction with the aid of a hook (Adler: North American Med. Review).—Pipe-stem in a child, æt. seven years. Adler saw him six days afterward; almost complete absence of respiratory murmur in the right lung; a harsh whistling sound was heard at intervals, similar to that produced by blowing through a pipe-stem. The decubitus on the left side produced an aggravation of the suffocation and an interruption of the respiratory murmur in the bronchial tubes of this side. If the patient then lay upon the right side, the dyspnœa diminished, and the air entered the left lung freely. A foreign body of the right bronchus was diagnosed, and this being placed, perhaps, above the rostrum, intercepted the passage of air in certain positions. Tracheotomy on the following day, four of the tracheal rings being cut. The right bronchus was then entered with an œsophageal forceps. The end of the instrument came in contact with the pipe-stem, which then passed into the left bronchus. All efforts at extraction failed, and no success was obtained with other instruments. It was then decided to trust to suppuration to expel the foreign body; but the symptoms increasing, on the following day, attempts at extraction were made with a metallic wire curved like a hook, which proved successful. Recovery.

These cases are undoubtedly rare, but they sometimes occur, and it is well to know by what signs they may be recognized. As we have seen, auscultation and the existence of the whistling sound have several times permitted the discovery of the situation and presence of the foreign body.

CHAPTER VIII.

THE CONDITION OF FOREIGN BODIES INTRODUCED INTO THE AIR-PASSAGES.

In order to pursue the same course with regard to the condition of the foreign bodies which was adopted with regard to the primary symptoms, I will examine, in succession, the history of those which are movable, and of those which are fixed in the larynx, bronchi, and lungs. In this man-

ner the reader will obtain a more exact account of the relative gravity of each of these accidents, and will discover that serious pulmonary complications may develop and compromise life after the disappearance of the primary symptoms.

1. The Fate of Movable Foreign Bodies.—The final evolution of movable bodies occurs very rapidly, because their presence in this condition is incompatible with the integrity of the respiratory functions. If the period of repose separating the paroxysms is very long, this condition may be prolonged for several days or even weeks; but sooner or later it terminates in one of the three following ways:

1. By spontaneous expulsion.
2. By asphyxia.
3. By the fixation of the foreign body in the bronchi or larynx.

A. *Spontaneous expulsion.*—Spontaneous expulsion is not extremely rare, and it occurs in the midst of a paroxysm of cough. In order that this occur, the glottis must give passage to the expelled foreign body during one of the noisy expirations of the cough. Sometimes it passes directly into the mouth, sometimes into the nasal fossæ, whence it is usually expelled into the pharynx and mouth. Are there any inherent properties of the body which favor this fortunate termination? We cannot define them, since pieces of kernels, shells, and cherry-pits have all been expelled. But it is evident *à priori* that smooth, regular, and small objects present greater chances of expulsion than others. These bodies are less irritating and less apt to produce reflexes which oppose the opening of the glottis. It is for this reason that foreign bodies which have remained for a certain length of time in the bronchi or trachea in a fixed condition are much more often expelled when they become movable, and those which have been introduced into the lungs are expelled without almost any accidents. The larynx has not been irritated during their introduction, or perhaps the violent spasmodic condition which accompanied their entrance has subsided, so that the glottis offers no resistance when they are pushed from below by a violent, expulsive effort.

B. *Acute asphyxia.*—Acute asphyxia is very rare in cases of movable foreign bodies, because one of the conditions of mobility is their small size, which always allows a sufficiently free passage of air. But we sometimes observe slow asphyxia produced by the persistence of the successive paroxysms which produce suffocation and functional disturbance sufficient to compromise life. On the other hand, when the glottis is very irritable, a spasmodic condition is produced whenever the foreign body is brought in contact with the glottis by an expiration; this is a source of numerous accidents, and may itself, perhaps, act as a cause of death. Finally, asphyxia may be added to other lesions, as in the following case:

Observation.—Apple-rind in the trachea.—Tracheotomy.—Death.—A child, three years old, who had been sick for five days, entered the Sainte-Eugénie Hospital, in 1864. The child had very marked dyspnœa, with sniffling during inspiration and expiration, but without any change in the voice. Tracheotomy was unsuccessful; she died, three days afterward, with tracheal râles. The integrity of the voice and the absence of false membranes threw doubt on the diagnosis of croup. At the autopsy the glottis and epiglottis were found healthy; the trachea contained a foreign body situated above the wound. It was a semi-transparent shell of a vitreous appearance, which resembles the kind of dry shell surrounding the seeds of an apple. This lamella was hard and as thick as a nail; it was found floating in the current of air. The trachea had a reddish-violet color internally, and contained puriform mucus. The lungs were the seat of lobular pneumonia; they were hepatized and contained masses

of crude tubercle. Bronchial glands enlarged and softened internally. (Bourdillat: Gaz. méd., 1868.)

C. *Fixation of the foreign body.*—The most frequent termination, and one which is the source of a great number of accidents, is the fixation of the foreign body in the larynx or bronchi. It is hardly necessary to add that the former termination occurs during a movement of convulsive expiration; the latter, on the contrary, during a movement of inspiration which carries the body to the bottom of the bronchi, especially the right. Small solid bodies, such as kernels and beans, chiefly enter during inspiration; but irregular objects, such as shells, etc., do not entirely obstruct the lumen of the canal and are pushed back into the trachea during the first expiration. Those, on the contrary, which are at first movable and then become fixed in the larynx, consist entirely of sub-glottic foreign bodies, and are usually irregular, like pieces of shell, or have a very large diameter, like coins placed on edge at the level of the cricoid cartilage. Examples of this kind are relatively frequent and present a great analogy in their mode of production. As a rule, the patient has numerous attacks of suffocation with very violent paroxysms of cough for several days; they do not disappear entirely, but are accompanied by a fixed pain, either in the bronchi or in the region of the larynx. This is the best indication of the moment at which fixation has occurred; furthermore, in the larynx, the bruit of tracheal chattering occurs with a whistling expiration and inspiration which are characteristic of sub-glottic bodies. The final evolution of these fixed bodies will be discussed in the following paragraphs.

If their stay has been somewhat prolonged, they almost always produce very acute inflammation of the trachea, whatever the termination may be. This inflammation may assume serious proportions, may extend to the bronchi and lungs, and sometimes cause death, despite the primary expulsion. But these are exceptional cases, and I have only met with two or three examples.

The Fate of Foreign Bodies fixed in the Larynx.—Examples of foreign bodies fixed in the larynx are not very frequent, because they are very rarely tolerated, and a prompt solution usually occurs when the passage of air is interfered with or when the spasm endangers life. There is no question in these cases of secondary symptoms, as the primary ones almost invariably terminate in death when the foreign body is situated in the glottis and is solid, or they pass into a subacute condition when the initial paroxysm does not carry off the patient.

All those which remain in the larynx may, at the end of a very variable period: 1, be tolerated; 2, be expelled; 3, fall into the trachea; 4, produce inflammatory or other complications; 5, cause death.

1. *Tolerance.*—The tolerance is never absolute, and it is rare that the symptoms are so slightly marked as in Corbet's observation, reported at the close of this chapter, in which the voice was not changed. Most frequently it becomes hoarse, deglutition is distressing, and respiration is almost always interfered with, so that we observe rather a relative than a real tolerance. Moritz Schmidt reports that a man, forty years old, kept a piece of wood, 0.01m. long, in the larynx for eight years. The foreign body, which was expelled spontaneously, had produced chronic hoarseness. Three or four years after its expulsion, traces of chronic inflammation were still found upon the vocal cords. The tolerance does not last so long, as a rule, and in the larynx it is rare that it continues more than several months, because sooner or later the sensibility of the organ renders it liable to be inflamed. There are very marked differences in this

regard between the different bodies, according to the situation which they occupy, their structure, shape, etc. Thus those which are placed on edge between the lips of the glottis, like fish-bones, needles, pieces of bone, are tolerated less than those bodies which, as we have seen with regard to cherry-pits, hollow out for themselves a small cavity in the thickness of the ventricle. Most frequently, also, this relative tolerance constitutes a condition of very distressing malaise, and does not merit the name unless we compare these symptoms with those which characterize the initial paroxysm and usually endanger life. This is shown by the following case, published by Whistler.[1] It referred to a bone of mutton retained in the larynx for five weeks. During this entire period the patient had stridulous respiration, cough, mucous expectoration, often streaked with blood. Despite the size of the bone, which measured almost an inch in length and three-quarters of an inch in width, life was not endangered.

Desault's case—in which a patient, who had a cherry-pit in the ventricle of the larynx, refused all aid, and died two years later—is usually quoted as an example of tolerance of the larynx.

Watson reports that a gold coin was lodged for years in one of the ventricles of the larynx without severe symptoms.

In conclusion, this tolerance is exceptional, and there are almost always other symptoms which precede expulsion or delayed evolution.

2. *Spontaneous expulsion.*—In the great majority of cases the expulsion is primary, and occurs very rapidly; but it may also occur accidentally after several months of relative tolerance. We can understand how a body, which was for a long time enclosed in the ventricle, can become movable at a given time, and how, by the progress of an ulceration, a bone enclosed between the lips of the swollen and inflamed mucous membrane can be disengaged. These occurrences are very rare, and when spontaneous expulsion takes place, as has been observed in some cases, it almost always occurs by means of a purulent collection, which, forming around the enclosed body, suddenly opens into the air-passages and carries the object along with it. The following observation, by Travers, is a very curious example of this mode of termination:

Observation.—Expulsion of a cherry-pit by the opening of an abscess into the bronchi.—A little girl fell backward while eating cherries, and was immediately taken with violent intermittent paroxysms of suffocation, which became more and more intense. Travers performed tracheotomy; the respiration immediately became tranquil, the cough ceased, and the child fell asleep. The improvement continued, and the wound healed. Cough developed two months later, attended with night-sweats and great weakness until, during a violent coughing fit, the pit was rejected in a spoonful of pus.

All authors reproduce this as an example of tardy and spontaneous expulsion of a foreign body of the larynx. But should we not raise some doubts as to its exact position, when we find the remote symptoms identical with those which are usually produced by substances which have been arrested in the bronchi for a long time? I think that these errors with regard to situation are not rare, and that the facts have often been wrongly interpreted. Can we really attribute the following case, which is quoted by W. Rose,[2] to a laryngeal foreign body, and must we not rather regard it as a case of expulsion of a pulmonary foreign body? I incline to the latter view.

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[1] The Lancet, 1876.

[2] Gaz. méd., 1844.

Observation.—Expulsion of a foreign body at the end of ten years.—A fruit of the beech-tree was swallowed by a little girl six years old, and was not expelled until ten years afterward. One day she had a paroxysm of coughing, and passed about half a pint of purulent matter. Finally, after having remained in the larynx for nearly ten years, the foreign body was expelled after a coughing fit.

We cannot admit, as Laboulbène does, that such a quantity of pus could form around a foreign body beneath the glottis without producing serious accidents and asphyxia.

In fine, everything leads us to believe that among the small number of fixed bodies which are tolerated in the larynx, exceedingly few are expelled naturally, and, in the chapter on treatment, we will find that it usually becomes necessary to disengage them, either through the pharynx or by means of laryngotomy.

3. *Fall into the trachea.*—As laryngeal foreign bodies, after having remained fixed for a certain length of time, may be expelled externally during expiration, so they may also fall into the trachea, either during an inspiration or from the effect of their own weight. Not alone do foreign bodies, which have come from without, act in this manner, but those also which are formed at the expense of the altered and necrosed cartilages of the larynx, as we find in tubercular phthisis or tertiary syphilis. This mechanism is not referred to in the very incomplete observations of authors, and the suddenness of the accidents, which appear when least expected, tends to make them unnoticed, as their gravity completely rivets the attention and they do not in any way indicate the origin of the accident.

4. *Inflammatory symptoms.*—We very often find that foreign bodies which are fixed in the larynx give rise to the production of inflammatory symptoms, some acute, the others subacute or chronic. When the bodies are irregular, they become fixed by their irregularities into the mucous membrane which swells up around them, and the spasmodic contractions of the muscles still further favor this penetration. This results in an acute inflammation of the larynx, an œdematous laryngitis, all stages of which may be observed with the laryngoscope, and which very often become very serious. This class of lesions, even in the subacute or chronic state, was unknown until the laryngoscope was used in observation. Previously everything which referred to the pathology of the larynx, and especially to the secondary symptoms of fixed bodies, was restricted to subjective and functional symptoms. During the last fifteen years a small number of well-observed cases have removed all doubt concerning the existence of this œdematous laryngitis, and in the chapter on treatment we will find examples which are so much the more striking, as the swelling of the mucous membrane renders expectoration much more difficult and the manipulations of extraction uncertain.

Abscesses of the larynx are not very rare under these conditions, and they are shown by the expulsion of purulent sputa, the beginning of which has been very sudden. When they are open, they continue to secrete, ulcerate, and form small cavities, at the bottom of which the foreign body is found enclosed. In some cases the autopsy has directly shown the presence of ulcerations, either localized or diffuse. It is useless to add that these complications do not disappear so long as the cause persists, that they produce severe functional disorders, and often have a fatal issue.

Termination in death.—Death is an imminent eventuality at all periods of the disease. When it occurs at the onset, it most frequently, as we have seen above, follows the presence of large sub-glottic foreign

bodies, which remain in the vestibule and do not pass between the lips of the glottis. Death may also occur when a smaller body is situated between the lips of the opening of the glottis, which are in a condition of spasm. It is produced less frequently, on the contrary, when a very large body, such as a cubic piece of carrot, the mouthpiece of a trumpet, forcibly separates the vocal cords and prevents the spasm. In the first two cases, the foreign body usually comes from without, but it may also come from the trachea or bronchi.

When death occurs at the end of a certain lapse of time, it is due to the accidents mentioned above, to the persistent irritation, and the inflammatory swelling, which all aid in producing the same end, viz., slow asphyxia in consequence of disturbance of the respiration. Tolerance may be very complete for a long time, then suddenly reappear with the same intensity as in the beginning, and cause death. In this regard the following observation, which is instructive in more than one particular, shows how a fatal termination may occur despite very slight lesions and despite two tracheotomies.

Observation.—Swallowed cherry-pit.—Double tracheotomy.—Death.—A child, æt. two years, while eating cherries, the pits of which he swallowed, was taken with violent fits of coughing and alarming paroxysms of suffocation. Corbet, finding asphyxia imminent, immediately performed laryngo-tracheotomy according to Boyer's plan. The danger was removed, and the child was saved. A careful exploration did not reveal the presence of the foreign body; it was thought that the pit had passed into the pharynx and had then been swallowed. The symptoms disappeared entirely, the canula was removed, and the wound cicatrized. Two weeks elapsed, during which the child experienced nothing unusual on the part of the respiratory apparatus and remained perfectly well. The tracheal fistula had entirely closed, and the external wound was almost healed. Corbet was then suddenly called, as the child was *in extremis*. A new operation was performed, and the wound was again opened throughout its entire extent; a female catheter was introduced into the trachea. Respiration was immediately re-established, and the larynx and trachea were explored in every direction. The index finger of the left hand, being introduced into the mouth, was introduced so deep as to meet the tip of the right index finger which was engaged in the larynx through the wound. The foreign body was not discovered. Fresh attacks of suffocation occurred, and the child died in one of these paroxysms. At the autopsy the cherry-pit was found in the larynx. The right ventricle was hollowed out by a cavity formed by ulceration and moulded upon the foreign body. The thyroid cartilage was especially ulcerated at the level of the cavity. (Corbet and Poulet: Revue médicale, 1855.)

In concluding these remarks, we must refer to the fact that the actual data are often very indefinite with regard to the pathology of foreign bodies of the larynx, and that modern observations made with much greater care will be useful in clearing up more than one obscure point.

CHAPTER IX.

THE FATE OF FOREIGN BODIES FIXED IN THE TRACHEA AND BRONCHI.

When left to themselves, the foreign bodies situated in the trachea and bronchi may follow a very different course, according as they are expelled or tolerated, or according as an acute or slow inflammatory reaction is produced around them, which is very often more disastrous than

the accident itself. I will, therefore, study in succession the following different modes of termination, which I will divide into: 1, alteration of the foreign bodies; 2, tolerance of the bronchi and prolonged stay; 3, spontaneous expulsion of the foreign bodies; 4, migration of certain of them; 5, slow and chronic pulmonary symptoms which are due to their presence in the bronchi; 6, various disorders.

1. Alterations undergone by Foreign Bodies fixed in the Bronchi.—From their very nature some of the bodies which are fixed in the bronchi are susceptible of undergoing changes. This fact has often been noticed with regard to certain grains, which are found in a medium in which they are present under conditions favorable to their enlargement, imbibe fluid, and increase in size. Dry beans, which are so often the cause of this variety of accidents, act in this manner, and it has several times been noticed that, as an effect of this swelling, the epidermis was detached from the cotyledons and that the latter were separated. It is unnecessary to remark how often such a change may prove favorable, and we actually find observations in literature in which a fortunate termination from spontaneous expulsion was due to this modification in the structure of the foreign body. Unfortunately this slight advantage is counterbalanced by the distress which results from the swelling itself. In the beginning it prevents the production of mobility, and fixes the foreign bodies even more solidly in the bronchi.

But if the presence of these grains is more prolonged, we may even find that germination occurs, and this curious change was observed by Rendu, in a child, æt. 5 years, who expelled (on the 79th day) a black shell, consisting of the epidermis of the bean and the germinated bean, in the midst of a discharge of pus, long after tracheotomy. Other cases of this kind have been reported by Lebouis, Debout, and Mondière, and these cases are so readily understood and so classical, that it is unnecessary to insist further upon them.[1]

In Debout's case the two cotyledons were separated and contained a sprout one centimetre long. The bean had remained a month in the larynx.

Other bodies in the trachea and bronchi are changed by imbibition like the preceding ones. Such, for example, are bodies formed of agglutinated powders, like pills, which may be disintegrated after a while. Under this head the pill of Donatus has always been quoted, which, after having been introduced into the air-passages and producing intense initial symptoms, was expelled in fragments after the softening of its constituent parts had facilitated the expulsion. Clifford Albutt saw the same termination in the case of an aconite pill which had been swallowed "the wrong way." Such cases are undoubtedly very rare, but we very often see small particles of bread, and especially of the crust, enter the trachea, and produce acute primary symptoms, which terminate spontaneously and do not reappear after the individual takes a drink.

However, we must not base an expectant plan of treatment upon this event, because, despite tracheotomy, a crust of bread has caused death, the object not having been softened. The case published by Mitchell Henry[2] is instructive from this point of view.

Observation.—Crust of bread in the trachea.—Tracheotomy.—Death.—An infant, seven months old, inspired a crust of bread. Paroxysms of suffocation; tracheotomy an hour

[1] Arch. génér. de médecine, 4e Série, T. XXIV.

[2] Lancet, Oct., 1858.

afterward. The tracheal opening was kept patent by silver wires tied behind the neck, which was considered less dangerous than a canula, which may be very often obstructed. Improvement, but persistence of the foreign body. It was hoped that the piece of bread, whatever might be its position, would soften, and that, after it had been disintegrated, it would be expelled by expectoration. The child did well until the fourth day, but on the fifth day the mucous secretion increased and she died. An autopsy could not be obtained. (Bourdillat: Gaz. méd, 1868, p. 136.)

Even the hardest bodies, such as teeth, may undergo a slow change and subdivision in the lung. The following observation tends to prove this assertion:

Observation.—Tooth in the bronchi.—Expulsion at the end of a year.—Death.—Anæsthesia for the extraction of a tooth in a man; violent cough on return of consciousness. A year later, during a violent attack of asphyxia, the patient expelled a piece of a molar tooth (the root and portion of the crown), and, three months later, three other similar pieces. A catarrhal cough persisted all the time; slight attacks of pleurisy; at a later period very marked exudation on the right side. The symptoms gradually grew worse, and the patient died of phthisis.

At the autopsy the left lung was found healthy. The right lung was adherent; an exudation was present, especially marked in the mammary and axillary regions. No abscesses or cicatrices. Dilatation of the bronchi, which had become firm and devoid of epithelium. A cyst was found near the hilus of the lung, and in its centre a piece of tooth inserted into the fibrous tissue. (Strasser: Communication to the Jour. méd. suisse, 1862, p. 377.)

In conclusion, all organic bodies undergo, in the long run, a change, which varies greatly according to their texture. In one case a piece of meat becomes putrefied; in another, the greenish débris of a spikelet of grass is expelled by expectoration. Finally, and very rarely, foreign bodies remaining in the bronchi and trachea become covered with a calcareous layer and form calcareous concretions. Aronssohn [1] has collected several cases in which the foreign body was eliminated, after a long period, in the form of a calculus. He states, in particular, that a cherry-pit, having fallen into the right bronchus, gave rise to bronchitis, and that, after remaining there a year, it was expectorated, surrounded by a layer of phosphate of lime one inch in thickness. This will not surprise us if we remember the property of calcareous secretion which all the mucous canals may acquire under certain pathological conditions. However, cases of this kind are much rarer than Aronssohn believes.

Tolerance of the Bronchi and Lungs for Foreign Bodies.—Certain conditions are indispensable for the tolerance of foreign bodies which have become fixed in the bronchi. The first is that they should not completely obstruct one of the large bronchial ramifications, especially on the right side. They will also be better tolerated the more their composition will resist the action of the bronchial fluids, the better their shape can be moulded in the bronchial tubes, and, finally, the less irregular they are. Nevertheless we find foreign bodies tolerated for a long time, although several of these conditions are not realized. The bodies are very rarely contained in true cysts.

According to Guyon,[2] the examples of prolonged presence without lesions are exceedingly rare, and he has only been able to collect two cases.

One of them was reported by Mondière,[3] and refers to a lunatic at

[1] Thèse Strasbourg, 1856, p. 27.
[2] Dict. encyclop., 2e Série, T. I., art. Larynx.
[3] L'Expérience, 1840.

whose autopsy a bone was discovered in a bronchus which had remained there for six years without producing any symptoms. The other is that of Renault, and also refers to an autopsy, at which a nail, whose presence was unknown, was found in the lung. Many others may be added to these cases. Thus Royer Collard[1] found in the bronchi and larynx (at the autopsy of a lunatic) nails which had been swallowed several years previously without having produced the slightest symptom during life. Gross speaks of a piece of bone, which was expelled by coughing, after having remained for six years. Baldwin[2] has mentioned a case in which a coin revealed its presence, for four and a half months, by such slight symptoms that the physician did not believe that the accident had occurred.

If by tolerance we only mean cases in which the indolence persists until death, such examples are very rare. But if we also include those cases in which the foreign body remains indolent for a long time before producing any disturbance, the list will contain a large number of examples. Rose and Heyfelder have quoted well-authenticated observations which demonstrate the existence of tolerance for many years. In one case a wooden whistle remained for eleven years; Dupuytren saw a ten-sol piece also remain for ten years; Heyfelder, a piece of pipe for twelve years; Rose, a beech-fruit for ten years. Other authors speak of bones, crabs' feet, a louis-d'or, crayons, etc., which were tolerated for years without causing any serious accidents. Gross mentions as an example of long tolerance the case of a piece of bone which was expelled, in a coughing fit, after sixty years of indolence. If we throw a glance over the tables collected by authors, that of Bourdillat, for example, we are struck by finding that the most numerous objects, viz., beans, are the ones which remain for the shortest period, while pieces of bone appear to have a certain predisposition toward tolerance. Thus, among more than forty cases of the enclosure of beans, I have not found more than one in which one of these objects had remained for three years and a half.

The period at which tolerance is established is extremely variable, but it is rarely primary. As a rule, it is not produced until the spasmodic condition of all the contractile elements of the air-passages has disappeared and when the primary irritation has been somewhat quieted. Does the relative immunity of tubular or foreign bodies persist indefinitely? I do not think so; but the reports of cases are not sufficiently explicit in this particular. The asphyxial symptoms may be relieved at the outset, but the irritation follows its course none the less, and may give rise to accidents. The following observation belongs to this category, and is an example of indefinite tolerance of a hollow body after some initial symptoms. Bourdillat, in the treatise from which I copy this, regards it as a case of phthisis; this is undoubtedly a wrong interpretation.

Observation.—Indefinite tolerance of a coin in the respiratory passages.—Dr. Heider relates that a child, aged three and a half years, swallowed a coin, pierced by a hole in its central portion (Oct., 1860), which went "the wrong way." The child soon began to suffer from extreme terror, the respiration became panting and the face cyanosed. An emetic was administered without success. During the evening the child continued to breathe with difficulty, the face was pale, the cough frequent and energetic, the pulse rapid and small. Sanguinolent mucus was expectorated, and the larynx was tender on pressure. The child slept during the night, but sleep was interrupted by the cough; on the following day he was more quiet. An examination of the larynx and trachea revealed nothing especial. Upon auscultation a harsh ronchus was heard posteriorly near the bifurcation of the left bronchus, with finer râles in the vicinity. This

[1] Ac. de méd., Jan. 28, 1840.

[2] Phil. Med. Times, I., 1871.

gave rise to the belief that the coin was arrested at this spot, without, however, closing up the bronchus on account of the opening in its centre. As tracheotomy would not have permitted the extraction of the foreign body with certainty, the treatment was restricted to the administration of mucilaginous drinks and opiate potions, and the child was kept in-doors. At the end of several weeks the respiration became easier and the cough less frequent, but the sputa remained purulent and continued to be streaked with blood from time to time. The child became extremely emaciated. At a later period Heider found that the bronchitis had recovered. The health continued to improve during the following spring. Percussion over the side referred to showed marked diminution of vocal resonance over an area, including several ribs and as far as the axillary line externally, with absence of râles and feeble respiratory murmur. This led to the belief that the coin was encysted at this point, and that a part of the lung had ceased to functionate on account of the occlusion of the bronchus. Recovery became complete during the ensuing years.

Relative tolerance is not exceptional in cases of tubular foreign bodies, because the respiration continues to be effected as usual. It is not, however, indefinite, and sooner or later the chronic lesions may carry off the patient.

Observation by Kirchoff.—Caoutchouc tracheotomy canula remains in the right bronchus for two years.—Death.—A man, twenty-five years old, scrofulous, a drinker, who was affected with chronic laryngitis, was exposed to cold; the epiglottis and folds were so swollen that he was threatened with suffocation. Tracheotomy; incision of the crico-thyroid membrane; introduction of a large, double caoutchouc canula. No more dyspnœa, but the latter returned whenever the patient attempted to remove the canula. A year later he was examined by Czermak, who discovered cartilaginous thickening of the epiglottis and a morbid change of the vocal cords; he left the canula in place. Two years later, on the day following a feast, the outer tube was detached from its point of support as he was withdrawing the inner tube. In the afternoon it was felt behind the cricoid cartilage, but could not be grasped with a curved forceps on account of its hardness; it slipped further down and disappeared. The thoracic symptoms subsided somewhat after the introduction of a new silver canula. At the end of two years, emaciation and continually increasing expectoration. The patient died of acute bronchitis, but an autopsy could not be obtained. (Deutsch. Zeitschrift f. prakt. Med., 1876.)

Spontaneous Expulsion.—This termination is the most frequent of all, since among 167 cases collected by Bourdillat expulsion by the mouth occurred 95 times. But cases of operation are included in this number, so that such great importance must not be attached to spontaneous expulsion from the unaided forces of nature. It is sometimes primary, and occurs before the inflammatory symptoms have had time to declare themselves; sometimes, on the contrary, it only occurs late, either from an accidental cause or from some special pathological process. When the expulsion occurs primarily, the foreign body has not been pushed very deep into the bronchial tubes and still enjoys a certain amount of mobility. It is exceptional, on the contrary, whenever the foreign body is firmly fixed in consequence of swelling or of its peculiar shape. The volume of the body introduced also plays a great part, for we know that all those whose diameter is more than four lines in every direction cannot be expelled by the unaided forces of nature. This termination almost always follows a violent paroxysm of cough, during which the foreign body, being displaced and movable, is projected into the trachea and from thence into the mouth. It has been observed that the more deeply the foreign bodies are situated, the more readily they are expelled. This does not imply that this mechanism always terminates in expulsion, because, when the foreign body has once reached the trachea, it acts precisely like those which are movable and to which we have referred above. Thus it is not very rare to find them fall back into the other bronchus or

even lodge in the larynx. Certain circumstances favor expulsion. Marcelin Donatus quotes the case of a pill, which, having fallen into the air-passages, was disintegrated, dissolved, and promptly expectorated. Mondière reports a similar fragmentation of beans—in one case on the third day, in a second on the sixth day.

In addition to this primary expulsion, which is very common, we must mention another form, viz., late expulsion, which occurs from the same mechanism, but from different causes. The foreign body, from its prolonged contact with the bronchial mucous membrane, sometimes produces an ulceration which has been observed on several occasions, and then, after it has become free and movable, it may be set in motion by the inspired or expired column of air. Sometimes the purulent collections which have formed around or beneath the foreign body open into the bronchi and carry it along. The mechanism is not the same under these two conditions, and nature resorts to different measures in order to effect the same end, viz., the mobility of the object. In this case, as in the preceding one, after symptoms which vary greatly in intensity and are sometimes latent, a bronchial irritation supervenes, which gives rise to paroxysms of cough ending in the expulsion of the object. In Frankel's case, a pearl, which was swallowed by a little girl six years old, was expelled fourteen weeks afterward.

A tooth was expectorated two years after its penetration into the bronchi, and recovery ensued. In Suë's case, expulsion occurred seventeen years after the accident.

Beneys' observation.—Bullet swallowed.—Symptoms of phthisis.—Expulsion after administration of an emetic at the end of forty days.—A young baker, æt. 21 years, was attacked with bronchitis on March 10th, 1851. Being unemployed one day, he accidentally swallowed a pistol ball weighing ten grammes. Paroxysms of coughing; while sleeping, a strong inspiration caused the foreign body to descend into the trachea and right bronchus. The patient then had an attack of suffocation, and made great efforts to cause the bullet to rise. This condition of anxiety lasted for a few minutes, but quiet was gradually restored, although the patient felt the presence of the bullet on the right side of the chest. From this period the cough became incessant, and the patient passed sleepless nights; the days were less distressing. He lost appetite, fever supervened, and emaciation progressed rapidly. When Beneys saw him (37 days after the accident) he thought, from all the symptoms, that the patient was suffering from phthisis pulmonalis in the third stage. Three days later (May 2d) the patient had several paroxysms of suffocating cough, and in an effort, during which he stooped out of the bed, he vomited a leaden bullet with about three tablespoonfuls of pus. The patient then confessed the accident. His health gradually improved, and he recovered in two months. (Bulletin de thérapeutique, T. 42, p. 27.)

Foreign bodies which have been expelled may then be swallowed. Warren has seen a horse-shoe nail expelled from the bronchi of an infant, then swallowed and passed in the stools some time afterward.

Instead of pus, the rejected fluid may be blood, and the foreign body is displaced on the occurrence of the hæmoptysis.

Observation.—A patient, who is referred to in the Gazette de Strasbourg (1876), presented all the functional and even the physical symptoms of a cheesy pneumonia. All the symptoms disappeared after the sudden occurrence of an attack of hæmatemesis. A very sharp, triangular piece of bone was found at the bottom of a basin nearly full of blood.

Two events may come to pass after the foreign body has been expelled: either the lesions produced by its presence are very slight, and recovery then occurs very quickly, in fact, almost immediately; or, during its stay,

it has compromised a portion of the organ and affected its functions, and the recovery is then incomplete. We find that, despite the expulsion, the symptoms continue in these cases and may prove fatal.

Migration.—This general term includes a very large number of cases, to which has been applied the title expulsion through the thoracic walls, in which the foreign body undergoes gradual displacement, which is not necessarily of an inflammatory nature, and the history of which is far from being complete. This does not imply that cases of this kind are wanting in science. They present the very curious peculiarity of only having been observed with regard to heads or spikelets of wheat, grasses, etc. Among 367 cases Bourdillat collected twelve, and among this number there were only one needle and a bone; but a much larger number is recorded in literature, as Desgranges[1] had published sixteen examples as early as 1812.

This apparently simple question raises one of the most difficult problems in pathology, and one which has been agitated for centuries. Even Hévin, who is so competent an authority on all that refers to foreign bodies of these regions, believed that all these heads of grain which had passed through the thoracic walls came from the œsophagus and not from the air-passages. Louis, who was at first sceptical, afterward admitted that they came from the lungs. In 1812 Desgranges wrote several articles to prove the truth of this statement.

Vigla adopted Hévin's views, and Guyon believes that if certain cases are doubtful, there are others in which the objects have undoubtedly come from the air-passages, and he bases his opinion upon the rapidity with which the abscess forms, upon its usual situation at the anterior or lateral portion of the thorax, and upon the presence, in certain cases, of pulmonary inflammatory symptoms. Unfortunately pathological anatomy has not settled this question, so that we can only reason by induction, and, after a rigorous examination of a large number of these cases, I believe that the large majority come from the œsophagus and a small number from the air-passages. Very few authors mention immediate and severe attacks of suffocation in discussing the circumstances and symptoms which accompany the introduction of these objects. Is it possible that bodies which are so irritating on account of their mere form should not become the source of very great suffocation during paroxysms of cough! Such phenomena are not mentioned by authors; in many the initial symptoms are passed over unheeded or even unnoticed.

I cannot admit that a head of grain three-quarters of an inch long can produce such slight symptoms as to justify an author in writing: "A child was affected with broncho-pneumonia, and remembered having had a stalk in his mouth." (Aronssohn). This primary benign character is much more rational under the hypothesis of œsophageal ingestion which occurs with similar results. In 1812 Maunoir discarded the hypothesis of the introduction into the air-passages, which had been established by Desgranges, and he stated that "we cannot conceive that at the invasion of the disease there should be an absence of all symptoms depending on suffocation."[2]

The other arguments relied upon by defenders of the theory of pulmonary migration do not appear to me to be trustworthy. Thus œsophageal foreign bodies may pass more quickly into the surrounding cellular

[1] Jour. gén. de méd., T. XLIV., p. 130.
[2] Maunoir: Thèse de concours, Montpellier, 1812.

tissue than those in the air-passages, as much by their spontaneous perforation as by the effect of the contraction of the œsophagus upon them, and the rapidity of certain hemorrhagic or other accidents is a well-known proof.

In a similar manner, their situation is not so constant as Guyon believes, and it corresponds at least as often to the posterior part of the costal arches as to the lateral parts. They very rarely open anteriorly. Desgranges has stated that in sixteen cases the abscess formed seven times on the right side, which verifies the greater frequency of introduction into the right bronchus. This view is evidently erroneous, as nine cases remain for the bronchus which should have been less favored than the others. Finally, the escape of air has been noticed several times, but its presence in these collections is explained equally well by the intra-pulmonary migration of bodies which have passed through the œsophagus.

Although the association of pulmonary inflammatory symptoms does not possess an absolute value, it is nevertheless much more important; and, until new investigations have decided this pathological problem, we are justified in the belief that those bodies have come from the air-passages, whose escape is accompanied either by acute or chronic bronchitis, or by communicating pulmonary fistulæ. No doubt can possibly be entertained in the following case, reported by Bonet:

Observation.—Ear of wheat swallowed.—Thoracic abscess.—A little girl, one year old, swallowed a head of wheat. On the fifteenth day a fluctuating tumor formed on the right side near the upper ribs. It was opened and the wheat withdrawn. The whistling of the air which escaped through the wound did not permit the least doubt upon the question as to whether the lung had been traversed. (Bonet: Med. Sept., Lib. 3.)

In conclusion, cases of pulmonary migration are rare, and with Hévin I am led to believe that the largest number of cases of this kind are due to bodies which have escaped from the œsophagus.

The migration may occur in two different ways: either without inflammation, or through the intervention of a purulent collection which favors the displacement of the foreign body. In the first period the body perforates the bronchus in which it was fixed, and penetrates into the pulmonary parenchyma, which becomes slowly inflamed and allows the object to pass. The inflammation remains plastic if there is no suppuration, while it develops more completely in the other cases. Whatever may be the method employed by nature, the foreign body reaches the periphery of the organ, and adhesions form between the two layers of the pleura.

At this period fever develops if no abscess has formed, and increases if the pus has favored the migration, and the patient complains of an acute pain in one of the ribs or in the back. If attention is drawn to this point, we will soon be able to discover a tumefaction, which is nothing but an abscess in process of formation. The latter opens or is opened, and gives vent to pus of a very poorly formed character when it originates in the lungs (it is distinguished in this manner from an abscess starting in the œsophagus); sooner or later it carries off the foreign body or its débris. It is not rare to find a communication made either at once or at a later period between the bronchi and the wound, characterized by the hissing of the air during inspiration and the presence of pus mixed with air during expiration. If, on the contrary, the migration has occurred without a primary pulmonary abscess, the communication is not made, and the events occur in a much simpler manner, and the recovery

is more rapid. How long a time must elapse before this migration can be consummated? We cannot answer this question in a definite manner; it may occupy several weeks and sometimes months in its production.

Finally, this migration of foreign bodies may be the cause of fatal accidents, because, if the opening of the pleura occurs before the protecting adhesions are sufficiently established, the purulent collection will open into the serous membrane and will soon threaten life. Leclère has quoted examples which are opposed to the optimism of Desgranges, who writes under this head: "But nature is too wise and foreseeing to expose herself to such dangers."[1] A chronic inflammation may also carry off the patient; but I shall soon return to these facts.

Acute and Chronic Secondary Pulmonary Symptoms.—Some are mechanical accidents, like emphysema; others are acute or chronic inflammatory symptoms, among which those most frequently observed are bronchitis, pneumonia terminating in resolution, abscess or gangrene, pleurisy, and, finally, the cheesy phthisis peculiar to foreign bodies of the lungs.

1. Pulmonary Emphysema.—This symptom was noted for the first time by Louis[2] in an observation, which is celebrated, because it is one of the first well-observed cases of foreign bodies in the air-passages, and in which the indications for active treatment, which was unfortunately negatived by the timidity or ignorance of the consultants, had been clearly defined. Its length will not permit me to reproduce it. It referred to a little girl, seven years old, who had swallowed a dry kidney-bean, which had fallen into the air-passages. In addition to other symptoms, well-marked emphysema appeared, from the second day, upon both sides of the neck above each clavicle—a symptom which had not existed two hours previously. It made no sensible progress up to the death of the patient. At the autopsy Louis found that not only was the air present in the cellular tissue of the neck, but that the lung and mediastinum were also emphysematous.

Two varieties of mechanism may be called upon to explain its production, but in Louis' opinion the second one is alone true. "We may imagine that the foreign body had produced forced dilatation of the trachea and rupture of the membranes which unite the cartilaginous rings of this canal on account of the obstacle which it had presented for forty-eight hours to the free passage of the air." Is it not more rational to admit "that the retention of the air, which is obstructed by the foreign body at each expiratory movement, especially during coughing spells, produced a violent reflux of this elastic fluid toward the surface of the lung and into the spongy tissue of this viscus?" The air then passed into the subpleural tissue, mediastina, and neck. Since Louis' observation, and despite the opinion of this illustrious author, who almost believed that emphysema was an essential symptom of foreign bodies of the air-passages, this accident has only been found in a very small number of cases. Sometimes it has appeared from the beginning, as in Louis' case; sometimes, on the contrary, it has developed much later and even as long as six months after the accident.

Moreover, it does not present the same characteristics in all cases, and it is not impossible that its slight extent, added to the difficulty of observation, is the reason why it is not more often observed. In fact, when it is limited to the lungs, that is to say, when it is not very intense, as in

[1] Jour. de méd., T. XLIV., p. 138. [2] Mém. de l'Acad. royale de chirurgie.

Lescure's case,[1] it is very difficult to detect it in the midst of the co-existing bronchial symptoms, and perhaps the supplementary respiration, mentioned by Jobert, is only a personal interpretation of the existence of this emphysema. But this can only be cleared up by further observations. However this may be, cases of its propagation to the mediastinum and cellular tissue of the neck are very rare. Hardly any cases are known with the exception of those of Roché.[2] A few analogous cases have been reported in England and other foreign countries.

The appearance of emphysema is a disastrous symptom, which renders the prognosis much graver. Death has occurred within a short period in all or almost all the cases.

2. Bronchitis.—Bronchitis and tracheitis are the most frequent of all the pulmonary symptoms, but they do not always attain a very high degree of intensity, and do not develop at the same period. When the bronchitis appears at the onset or a few days after the fixation of the foreign body, it may be very narrowly localized, and is evidenced by frequent cough, frothy, mucous expectoration, sibilant râles, at first localized in one well-defined spot, which may involve one or even both lungs if the affection does not recede. It is not rare to find it assuming an intermittent form and having several relapses during its presence, as in the following case:

Observation.—Plum-pit in the air-passages for six months.—Bronchitis.—Tracheotomy.—Recovery.—A child, six years old, had a plum-pit in the trachea for six months. He had had some attacks of bronchitis in the interval, and he entered the infirmary on account of this affection. The child persisted in the statement that the pit still remained in his chest. At the infirmary he was found to be suffering from acute capillary bronchitis; resonance was normal on both sides. The air entered the lungs freely, and nothing special was observed except a suffocating cough, commencing like an ordinary cough and stopping suddenly. At this time the child carried the head forward in order to vomit. On another day absence of vesicular murmur was recognized in the right lung; tracheotomy, spontaneous expulsion of the foreign body after two or three expirations. Recovery. (Oxley: Lancet, 1877, p. 843.)

If the foreign body remains for a long time and an acute bronchitis has developed, we may find it pass into the chronic condition and continue for months. It then constitutes the only appreciable affection, and the hesitation of the surgeon in the presence of these symptoms is as justifiable as it was in the preceding case. In some others, after having lasted for a long time, it disappears spontaneously despite the presence of the foreign body, which has been expelled for a long time afterward. Monkton's observation is an example of this mode of termination:

Observation.—Tolerance after the primary symptoms.—Spontaneous expulsion twenty-three weeks later.—A child, seven years old, was brought to the West Kent Infirmary, on October 3d, 1862, in a condition of extreme dyspnœa, and unable to speak or to hold himself upright. He was cold, cyanosed, and evidently at the point of death from suffocation. He was at first suspected to be in the last stage of croup, so much did the sound of the respiration simulate that of the latter disease or even that of stridulous laryngitis. On the previous afternoon, upon returning from school, the child had told its mother that he had swallowed half a nut-shell, which had caused a great deal of suffering for several minutes. At this time he appeared to be well, and, with the exception of an attack of suffocation, this condition had continued until ten o'clock in the morning. The symptoms of asphyxia then developed, and the child was brought to the hospital. He was kept quiet, and, as a precaution, the instruments necessary

[1] Mém. de l'Acad. de chir., T. XIV., p. 427.
[2] Bull. de la Soc. anatomique, 1859.

for tracheotomy were kept in readiness. After resting for two hours, the respiration returned almost to the normal condition. The voice was natural, and the air penetrated every portion of the lungs. Under these circumstances, as the presence of the foreign body in the air-passages might be doubted, since no one had seen the child swallow the shell, tracheotomy was not performed, the child being, however, carefully watched. On the following day respiration had become almost normal; there was slight expectoration and cough; the child ate tolerably well, drank, and slept. The surgeon-in-chief performed several manipulations in order to dislodge the foreign body, but without avail. The child remained six weeks in the hospital. During the first three the symptoms observed were those of a bronchitis of moderate intensity. The râle and respiratory murmur presented the same characteristics in both lungs. Usually, but not constantly, a noise like that of a flapping sail was heard between the two scapulæ during inspiration and expiration. At the end of six weeks, although emaciated and not entirely restored, the child was returned to his relatives, who were requested to bring him once a week. Nothing was discovered at these visits, except that a sort of vibrating noise was sometimes heard, which ceased entirely, however, six weeks after his discharge. On account of his good health, the continuance of these visits was not insisted upon, and the child was lost sight of for a while. On the 15th of March, however, the mother returned, carrying in her hand the half of a nut-shell, which had been expelled the previous night during a vigorous expiration, twenty-three weeks after its introduction. Monkton presented the piece of shell, which was as large as half of a large hazel-nut, and which was scarcely altered, except that the edges were slightly worn and rounded.

Although the bronchitis is very often of a mild character, it is frequently sufficiently severe to cause death, and then adds its disastrous action to the imminent asphyxia. Some cases of death after tracheotomy and after expulsion of the foreign body were due to the existence of a bronchitis either previous to or after the operation.

The development of this disease will be much more dangerous if a pathological predisposition exists prior to the introduction of the foreign body, as in a case reported by Cheever,[1] in which an infant, eighteen months old, who had whooping-cough, swallowed a match. An immediate aggravation of the symptoms of the bronchitis occurred, and the child died.

3. Pneumonia.—This very rare complication occurs under two distinct forms, viz., acute and chronic pneumonia. The latter is much more frequent than the former, which has only been observed in a small number of cases. It is sometimes arrested at the period of red hepatization, and then terminates either in death or resolution; it sometimes runs its course completely and ends in the formation of pulmonary abscesses.

It advances in some cases with great rapidity, and assumes almost the appearance of a gangrenous pneumonia, as in Féréol's case:

Observation.—Pneumonia following the introduction of food.—Death.—An idiot, fifty-five years old, died of pneumonia with red hepatization. After having eaten a great deal, he had had an attack of vomiting, during which a portion of the food passed into the bronchi. He died within twenty-four hours in a condition of coma; the hepatization occupied the lower half of the left lower lobe. The bronchi of this lobe contained a putrid, grayish mass. (Féréol: Mouvement médical, 1873.)

When it develops at a later period, its consequences are usually none the less disastrous, as in the following case, quoted by Aronssohn:

Observation.—Pneumonia after the introduction of a bean.—Küss had occasion to observe a case of tracheotomy for the introduction of a bean which had been introduced into the bronchi. The operation was unsuccessful, and the wound healed. The

[1] Boston Med. Journal, Sept. 28, 1876.

child died a month after the accident. The autopsy showed the bean fixed at the entrance of the right bronchus; the lung on the same side was hepatized.

Observation by Vacher.—Chaff of hemp in the lung.—Pneumonia.—Death.—Vacher, a skilful surgeon of Besançon, reports that a woman, æt. fifty-seven years, of a vigorous constitution, while breaking hemp on a bench in order to remove the boon, swallowed a bit of the chaff without noticing it. She was not left long in doubt, as she was seized shortly afterward with a painful cough and great difficulty in speaking. She complained of a continual pricking sensation in the fauces, and died in less than three days. The bit of chaff was found in the first subdivision of the bronchi, which are distributed to the left lobe of the lung, being situated transversely, like a bar, in such a manner as to prick the inner walls by its two ends. The lung was inflamed. (Hist. de l'Acad. des sciences, 1738.)

If frank pneumonia is very rare, the examples of pleuro-pneumonia are a little less so, and testify to the intensity of the irritation produced. Thus the reed of a whistle, lodged in the left bronchus, has been known to produce pleuro-pneumonia on the eighth day. Death occurred three days afterward, and upon autopsy the left lung was found in a condition of gray hepatization.

Observation.—Pleuro-pneumonia in consequence of a foreign body.—Recovery.—In another case, quoted by Bourdillat, the pleuro-pneumonia began on the fourth day; sputa mixed with blood and pus; cough harsh, voice muffled, respiration short and noisy, and occurring fifty-six times a minute; pulse 150; face cyanosed. Slight jaundice, prostration, dulness on the right side over the lower two-thirds, with diminution of the vibrations. Mucous and sibilant râles were heard upon auscultation over the right side. Sonorous and clicking râles were heard on both sides, but to a less extent on the left. Tracheotomy was performed, and recovery occurred. (Gazette médicale, 1868.)

Observation.—Handle of umbrella in the left bronchus.—Death.—A small piece of the handle of an umbrella lodged in the left bronchus and completely obstructed its lumen. Pneumonia followed, which terminated in gangrene, purulent pleurisy, and death. At the autopsy the unrecognized foreign body was found to have ulcerated the bronchus at the obstructed point.

A patient very recently died in Prof. Richet's service at the Hôtel-Dieu, of double pneumonia, caused by the presence of a small sponge at the rostrum of the trachea for five days.

To these observations we may also add some others which developed during the course of the disease, and which have not always had a fatal termination, though this complication is very grave.

The transformation of pneumonia into abscess of the lungs is much less rare than the preceding accidents. I have already had occasion to quote some examples in discussing migratory foreign bodies. This process usually occurs slowly, and when the collection has reached sufficient dimensions, it opens into the bronchi, pleura,[1] externally, or even into the colon.

I will report a few illustrations of these various terminations.

In the following case the opening occurred into the bronchi and through the thoracic walls at the same time.

Observation.—Bone of mutton in the bronchi.—Chronic pneumonia.—Toward the close of the year 1859, a blacksmith, æt. 26 years, swallowed a piece of a bone of mutton, half an inch long and a quarter of an inch wide. Suffocation, expectoration of blood, cough, sputa sometimes purulent. The body could neither be detected nor expelled. Emaciation after the lapse of a month. At the end of two months the pus

[1] Leclerc: Th. Paris, 1863.

was expectorated in such quantities that it amounted to a litre daily. Six weeks after the accident he passed the piece of bone during a violent fit of coughing. Shortly afterward a pain developed on the left side, and a tumor formed at this point, which suppurated, opened, and gave vent to a large quantity of pus. Very marked improvement, and recovery shortly afterward.

We have seen that blades of grass have a special tendency to form thoracic abscesses, but they may also give rise to abscesses of the parenchyma, as in Rothmund's case.

Observation.—Head of barley in the bronchi.—Abscess of the lung.—Expulsion of vegetable débris.—A young man, sixteen years old, swallowed a head of wild barley. Strangling and suffocation for a few minutes, then calm. On the following day, a chill lasting three hours. Vomiting, dyspnœa, flashes of heat, fever, violent pains on the right side between the fourth and fifth ribs. *Statu quo* for twelve days. Vigorous spell of coughing. Nauseating pus, expelled through the mouth and nose, containing vegetable fibres. Dulness on the right side; cavernous breathing; fine vesicular murmur; pulse 124. On the following day, a second very fetid vomiting spell with expulsion of vegetable fibres. Very slow recovery in a year. (Deutsche Klinik.)

Finally, in the following case, the abscess opened into the colon, a termination which is very exceptional, and which may be compared to the bursting of an abscess of the liver into the pleura or bronchi.

Observation.—Secondary abscesses opening externally and into the colon.—A child, ten years old, swallowed the head of a chicken's femur, which entered the air-passages. A long and vigorous coughing fit, which was often renewed during the day. Respiration distressing and croupal; cough persisting. Left lung normal; right apex normal; dulness and absence of vesicular murmur below and anteriorly. Pressure painful over the right fourth rib anteriorly. An obstruction of the right bronchus was diagnosed. *Displacement of the foreign body, which was proven by the reappearance of the vesicular murmur.* Improvement. On the thirty-eighth day, pain in the right flank. Swelling below the last rib on the right side. Dulness, *abscess, puncture on the fiftieth day.* A pint of putrid pus was withdrawn; relief. Five or six putrid passages five or six days afterward; *it was thought that an abscess had opened into the colon.* Improvement, then pains in the region of the right angle of the colon for eight days. Coughing spell, which was followed by immediate relief. Thenceforward the air entered freely. It was thought that the bone had been swallowed or absorbed. Four months afterward the bone was expelled during a coughing fit; recovery. Slight subsequent oppression.

The abscess sometimes appears at a much later period, and the destruction produced is then very considerable, as the lung is found hollowed out into a large cavity, which compromises its functions; death may perhaps ensue, as in Struther's case.

Observation.—Chicken-bone in the lung.—Death five years afterward.—Abscess of the parenchyma.—In 1844, a young man, twenty-two years old, while eating some chicken, and laughing at the same time, was suddenly seized with a coughing spell and suffocation. He felt that a foreign body had entered the air-passages. The symptoms ceased after the lapse of an hour. Three months later he began to expectorate white frothy sputa, although his health had been almost immediately restored, and he had resumed his occupations.

These symptoms increased, and the patient died five years afterward. At the autopsy a cavity as large as an orange was found at the apex of the right lung. It contained a brownish fluid, having the consistence of cream and a very gangrenous odor. Another abscess, which was found in the posterior part of the same lung, had opened into the bronchi. A small piece of bone was found free in this cavity, and at the bifurcation of the right primary bronchus. The left lung was comparatively healthy. No tubercles were found in any part. Enlarged bronchial glands.

From all these examples we find that pneumonia may occur in a chronic form which may become purulent. This is one of the most serious

complications, because it gradually weakens the patient on account of the indefinite suppuration, and because, despite the expulsion of the foreign body, the chronic lesions may be sufficiently grave to continue and cause death. In this respect this termination presents great analogies with that of the cheesy pneumonia, which I shall now discuss.

4. Cheesy Pneumonia, or Phthisis.—It is undoubted at the present time that the presence of foreign bodies in the bronchi, and in a more general way their presence in the lung, greatly exposes the patients to the development of phthisis. But this affection, except in predisposed individuals, almost always assumes the cheesy form, remains localized in one lung, and almost always on that side on which the irritating body is situated. It develops very slowly for years, and begins by an ordinary bronchitis, which becomes chronic and purulent. The symptoms by which it is manifested are identical in all respects with those of ordinary phthisis; and hæmoptysis, which usually occurs very late, is a characteristic phenomenon. This affection, which is produced by a continuous irritation, is distinguished from ordinary phthisis by the fact that if the lesions are not too severe, and if the functional changes have not compromised life, recovery from all the symptoms occurs after the expulsion of the foreign body.

The proportion of this form of termination is much larger than we would be led to believe at first sight. Thus, among three hundred and thirty-six cases collected by Bourdillat, in thirty-six the patients presented symptoms of phthisis, and since his treatise was published I have met with a number of analogous cases.

In order to avoid all confusion, I hasten to say that some of them prove that the presence of the foreign body in the bronchi favors the development of tubercles in predisposed subjects. Gaëtan Stanski has presented a striking example, and the opinion advocated by Broussais[1] is thus found to be verified.

Obstruction.—Swallowed grain of oatmeal.—Abscess.—Death from tuberculosis at the end of nine months.—A woman, twenty years old, swallowed a grain of oatmeal. Violent but temporary suffocation; continual cough. Two or three days later, very intense pain on the right side of the thorax. Cough increased; sputa rusty; crepitant râles at the base of the right lung; dulness. Five or six days later, muco-purulent expectoration, which continued. The pulmonary symptoms persisted. Fluctuating tumor between the false ribs and the ilium. Two applications of the cautery. Escape of pus on the second day; temporary and incomplete improvement. Another tumor at the end of two months under the angle of the scapula; it was also opened by the cautery. A wick was passed through the openings, and, on withdrawing it, the grain was withdrawn, broken in two parts. The local symptoms then improved, but the signs of phthisis became more and more marked; the woman died nine months after the accident, and, at the autopsy, tubercles were found at the apices of both lungs. (Bulletin de la Société anatomique, T. V., p. 83.)

According to Stanski, the phthisis had existed previously. Although the antecedents of the patients were passed over in silence, the opinion of the author is the only one admissible, and it is probable that the changes occurring in the neighborhood of a foreign body, accidentally introduced, may act as an exciting cause, under the influence of which the development of the tuberculosis becomes much more active. This is still further proven by the fact that the phthisis of foreign bodies does not affect the apices so much as the other parts of the lung, and only involves

[1] Broussais: Histoire des phlegmasies chroniques, T. II., p. 175.

a single organ, a phenomenon which is very rare in cases of tuberculosis. This existence of unilateral lesions was looked upon as a differential sign by Broussais and Bertholle.[1] To this characteristic we must also add that the lesions are situated most frequently on the right side, and in the middle portions of the lung rather than at the apices.

This distinction being established, we will now discuss the peculiar cheesy variety of phthisis which slowly changes the constitution and affects the general health of the patients to such an extent that Bourdillat has proposed to term it "*marasmus of foreign bodies.*" Next to cough, which is the first symptom, emaciation is the most striking phenomenon, and is an evidence of the functional disturbance. In all these cases we are struck by the similarity of the symptoms with those of phthisis and with their regular succession. The termination is alone different, for recovery sometimes occurs after expulsion, while sometimes the issue is fatal, either because the object has not been expelled or because the lesions have been such that they were incompatible with life. Among Bourdillat's thirty-six cases, recovery occurred in twenty-three. This is a very peculiar fact with regard to this class of affections, and one which deserves to attract the attention of surgeons. I will confine myself to the quotation of a few cases. We will then see that the development of this class of symptoms may be very rapid.

In 1864 Gueneau de Mussy presented to the Medical Society of the Hospitals, a child, eight years old, who had swallowed a plum-pit, and, after the lapse of a certain period, suffered from all the symptoms of pulmonary phthisis. She only recovered her health after the expulsion of the foreign body. Laborde [2] has published a case in which the similarity of the symptoms with those of tubercular phthisis was such that a wrong diagnosis was made for a long time. I will take this as a type of the class, because it resembles a large number of others.

Observation.—Swallowed pebble.—Pseudo-phthisis.—Spontaneous expulsion.—Recovery.—In 1862, a child, æt. 10 years, who was said to have swallowed a pebble while playing, entered the "Hospital for Sick Children." There was no initial attack of suffocation, so that, except for the presence of local symptoms, his statement would have been disbelieved. Upon percussion marked dulness was obtained at the apex of the right lung posteriorly. Upon auscultation an abnormal bruit was heard in this region, which could be attributed to the creaking, and a "bruit de souffle" was noticed chiefly in expiration. These signs, added to a marked febrile condition, the nature of the expectoration, the abundant night-sweats, the weakening of the vital forces, and the progressive emaciation, led Bouvier, the chief of staff, to diagnose acute tuberculosis. The appropriate treatment was prescribed. Nevertheless the symptoms continued to grow worse, and, in the midst of symptoms of great intensity, the patient sank into a condition of adynamia, which justified the liveliest fears; at this time he was attacked by measles. He had real paroxysms of suffocation, and the evidences of general bronchitis were found in the lungs. On account of these complications, the patient sank into the last stage of exhaustion; but four days after the invasion of the rubeola he was seized with a paroxysm of suffocation of unusual violence, following which he expectorated a very large quantity of purulent matter. A reddish foreign body, which proved to be a pebble, was found in the midst of this matter. Immediate relief. All the general and local symptoms gradually disappeared, and recovery became complete.

Hæmoptysis was absent in this instance, but it is present in the large majority of cases. Hæmoptysis sometimes even constitutes the only appreciable symptom for a long time, and if there has been no initial paroxysm it would inevitably deceive the physician. Such, among others, is the following case:

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[1] Mém. de l'Acad. de méd., 1865.

[2] Gaz. méd., 1868, p. 705.

Wertheimer's observation.—Frequent hæmoptysis.—Spontaneous expulsion of the caudal vertebra of a rabbit.—A woman, thirty-eight years old, was seized with hæmoptysis, cough, and a stitch-pain in the right side for six weeks. At the end of three months another sudden hæmoptysis. Four months later, violent hæmoptysis and emesis, with expulsion of the caudal vertebra of a rabbit, completely macerated and provided with apophyses, partially broken, partially rounded. (Schmidt's Jahrbücher.)

Though the affection may develop as rapidly as in the previous case, it may also progress with extreme slowness.

Observation.—A six-sol piece had entered the air-passages of one of Dupuytren's friends. It remained passive for five years. Dupuytren proposed tracheotomy, which was refused. The patient, having departed for India, became affected with phthisis, and died ten years after the accident. The foreign body was found in a tuberculous cavity. (Dupuytren: Leçons orales.)

The lesions produced in the lungs have been observed several times on autopsy. In the beginning there is merely induration of the lung, which afterward gives place to softening, disseminated in isolated spots. These spots, which radiate around the foreign body, may unite in such a manner as to form a pouch filled with cheesy matter. Little by little the foreign body becomes enclosed in this mass, either primarily by ulceration or after the rupture of small adjacent collections into the bronchi. Usually, when the collection bursts, its products pass into the air-passages and produce a violent paroxysm of cough. The expectoration of this matter very often carries off the foreign body, and it is in this manner that recovery is effected in a large number of cases. Very advanced lesions were observed, on autopsy, in a case reported by Jean.

Observation.—Autopsy on a case of pseudo-phthisis caused by a foreign body in the bronchi.—A man, æt. 20 years, entered the Hotel-Dieu, in 1876, and died two days later. The entire apex of the left lung was the site of a cavity as large as a fist. Lower down there were some smaller ones communicating with the bronchi, and which were formed by bronchial dilatations. The right lung was healthy. A small cavity and a bony foreign body were found at the level of the lower border of the left lung, in the costo-diaphragmatic lobule. This object had the shape of a small sphere, six to seven millimetres in diameter, terminating in a sharpened point, and resembling the end of a crayon-holder or pen-holder. No tubercles were present in any part, and the parenchyma, which had not been destroyed, was carnified. The man died of acute meningitis of the convexity. (Bulletin de la Société anatomique, 1876, p. 307.)

The chronic inflammatory process has been equally well described and characterized in an autopsy made by Leuret upon a lunatic. Here, as in the majority of cases, we find a striking contrast between the condition of the two lungs, and also interesting data with regard to the bronchial lesions.

Observation.—Autopsy upon a lunatic by Leuret.—The right lung was found adherent to the costal pleura throughout almost its whole extent, but it crepitated and presented hardly any traces of alteration. The left lung, which was adherent to the costal pleura, was hepatized and filled with tubercles, the majority of which were softened. Upon cutting this organ, numerous tubercles were discovered, and upon examining the lumen of the bronchial tubes it was found that the lining membrane was red and thickened. The trachea contained a nail an inch and a half long, the elongated head of which was engaged in the left bronchus, where it had been retained. The wall of the bronchus, which had been in contact with the head of the nail, was ulcerated and its inner layer destroyed. The nail was covered with mucus and oxidized. (Journal général de médecine, T. 96, p. 220.)

Another patient, observed by Lanchester,[1] died in consequence of the

[1] British Medical Journal, 1877, p. 28.

displacement of the seed of a tamarind, four months after the performance of tracheotomy. The autopsy revealed a chronic pneumonia, with interstitial fibrous proliferation of the lung.

5. Hemorrhages from Lesions of the Large Vessels.—The violence of the attacks of suffocation and of the paroxysms of cough may be so great that the foreign bodies, being projected with force against the walls, become deeply imbedded at the level of the passage of the large vessels, and give rise to their perforation. A fatal hemorrhage will then result, as in Rokitansky's case, in which a small pointed body had been drawn into the trachea and was lodged in the innominate artery during a fit of coughing.[1]

6. Secondary Cerebral Phenomena.—Hamburger has reported a very curious case in which, after quite insignificant initial symptoms, cerebral disorders developed very rapidly. To this case I will add another, which may be compared to it, although it is not possible to actually understand the relations between these cerebral disturbances and the bronchial obstruction. Nevertheless the disappearance of the symptoms after the expulsion justifies us in attributing this baneful effect to its presence. The following are the facts in this case :

Observation.—Cerebral symptoms cured by the expulsion of a pea.—An old man, seventy years of age, had an attack of syncope in a carriage, following which his intelligence remained weak and blunted ; amnesia ; anorexia ; weakness ; sad, morose disposition. Sudden change ; insomnia. An hour after the syncope, Hamburger found him in a febrile condition. Sensation, motion, and the organs of special sense were intact. Face red and anxious, the lips cyanosed. Respiration distressing, short, accelerated. No dyspnœa ; the right half of the thorax remains immovable. Absolute silence over the right lung ; no cough ; rapid increase of symptoms the same night. An emetic was administered prior to the performance of tracheotomy. Nausea. Coughing spell, expectoration of a green pea which was greatly swollen ; deep inspirations followed. The intelligence returned ; he then related that he had swallowed some green peas a week previously, one of which had engaged in the trachea. (Revue médicale, 1822.)

Valter has reported a case in which the cerebral disorders were much more severe and persistent, so that we may hesitate in attributing all the symptoms to the presence of a foreign body.

Observation.—Cerebral symptoms persisting for seven years, and cured by the expulsion of the claw of a crab.—A young man had swallowed the claw of a crab which he was sucking. An initial paroxysm, which soon disappeared. The symptoms of pulmonary phthisis appeared at a later period. A year afterward, cerebral fever, convulsions, chorea. Somnambulism, desire to bite, optical illusions, paralysis, suicidal mania. The patient was in a pitiable condition for seven years, when one fine day he vomited the claw of the crab, of which he had not thought in a long time, in the midst of some pus. From this time on, all the cerebral symptoms began to diminish, the phthisis improved, and health was completely restored. (Berl. klin. Wochenschr., 1873.)

We have previously reported a case of death from meningitis in the course of phthisis from the presence of a foreign body. Is there any relation of cause and effect in such cases? I am unable to answer this question, and confine myself to a mere statement of the facts.

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[1] Anatomie pathologique, T. IV., p. 37.

CHAPTER X.

DIAGNOSIS.

A SURGEON, when called to a patient who has been suddenly seized with a paroxysm of suffocation, and who presents alarming symptoms of asphyxia, should not hesitate a single moment, and, before making a diagnosis, he should open the trachea, because, whatever may be its cause, the first indication to fulfil is the arrest of the progress of the asphyxia. If, on the contrary, a very violent paroxysm should be followed by a slight calm at the moment of his arrival, he should make a diagnosis before doing anything else. Hence there are two very different lines of conduct: for, in the first case, we must, so to speak, make a retrospective diagnosis after treatment; in the second case, it must be made primarily.

In order to make an exact diagnosis, we must follow a regular plan in the examination of the patient, and successively determine: 1st, the existence of the foreign body; 2d, its situation in one or the other portions of the air-passages. Finally, we must bear in mind all the other affections of this kind which may lead to error.

1. IS A FOREIGN BODY PRESENT IN THE AIR-PASSAGES?—The patients or relatives can almost always give the physician useful information concerning the origin of the accident, the nature of the foreign body, and that of the objects with which a child was playing at the moment in which he began to suffocate. All these indications are of the first importance. They may immediately put an end to all doubt and enable us to pass to the determination of the situation of the object. The history will also furnish useful indications concerning the course and nature of the symptoms, and they possess at least as much value as a knowledge of the nature of the foreign body. They inform us that the onset has been abrupt, that the patient has suddenly become cyanosed, black, that he has been seized with a paroxysm of suffocation and a coughing spell which failed to stifle him, and that these symptoms subsided for a moment and then reappeared. In not a single disease of the air-passages is the beginning so abrupt, and the mere history should at once lead us to think of the presence of a foreign body. If no substance has been swallowed, we should inform ourselves as to the previous existence of some chronic laryngeal affection. In warm countries, when unusual symptoms of suffocation with hemorrhagic expectoration are manifested during a condition of perfect health, the hypothesis of the ingestion of leeches should present itself to us, as in Vital's case. But the history is sometimes wanting, especially in chronic cases, a fact which renders the diagnosis much more difficult.

In some cases the important initial paroxysm has not been observed or has not occurred. Finally, the relatives have been known to give erroneous information with regard to the nature of the affection, and attribute the secondary symptoms to an entirely different cause.

The subjective symptoms are also a valuable aid in clearing up the diagnosis. The most important one is the pain experienced by the patient and which is usually referred to a fixed point in the air-passages, most frequently in the larynx, sometimes in the trachea and lungs. He complains of a sharp pain, which is felt spontaneously in the neck or in

the back, and then to one side at a point corresponding to the division of the large bronchi. If the spot indicated is pressed upon, the pain increases sensibly. This is very often seen with regard to the larynx. Its existence is an excellent sign, which greatly aids diagnosis, but it is somewhat less valuable when we desire to determine the exact situation of the foreign body. In addition to this pain, we must also refer to the purely subjective sensation which the patients experience when a movable body is displaced in its passage to and fro in the trachea. Certain individuals can feel them even when they are stationary.

It is evident that none of these signs are furnished by little children, and that we can only expect them in adults. The history of Engineer Brunel's accident is very interesting in this respect, and shows all that we can expect from the intelligence of the patient in such cases. Some feel very distinctly the vibrations of a portion of a fixed foreign body under the influence of movements of inspiration and expiration.

Finally, there are objective signs, which enable us to predicate the existence of a body in the air-passages or their neighborhood, for almost all the subjective symptoms are common to foreign bodies of the œsophagus and air-passages.

The physician usually observes paroxysmal, convulsive cough, terminating in the expectoration of frothy, sanguinolent mucus, intermittent paroxysms of suffocation, acceleration of the pulse, and respiration, anxiety of the patient, and the *facies* peculiar to all cases of spasm of the glottis. The sensations furnished by the application of the hand to the trachea, the perception of the chattering bruit, the flapping or valvular bruit, the existence of sniffling respiration, and stridulous expiration, also point out the way with regard to diagnosis. He should immediately examine the chest by percussion and auscultation, take careful notice of the changes occurring in the vesicular murmur, and determine more clearly the existence of the peculiar bruits mentioned above. This examination, made rapidly in a few minutes, has no other object in view than to inform the surgeon with regard to the certainty or probability of the existence of a foreign body. When this is accomplished he should assure himself of its exact situation before proceeding further, and should determine whether the foreign body is situated in the pharynx, œsophagus, or air-passages. In order to do this, we employ the method of exclusion. We begin by assuring ourselves of the condition of the pharynx by examining it in the sunlight. We then make the patient swallow some mouthfuls of fluid; if deglutition is freely performed without causing pain or producing cough, there is reason to believe that the œsophagus is free. The surgeon performs this exploration by causing the patient to swallow some bread-crumbs, or, better still, by passing an œsophageal sound, with the greatest care, into this canal. Direct manipulations with the finger, which we have a tendency to perform, should not be made, because they may have very disastrous consequences. There are some cases in literature in which the penetration of a foreign body from the pharynx into the air-passages has been undoubtedly due to the reckless and inconsiderate manipulations of the surgeon. A case of this kind was reported only a few years ago in an English journal. If the œsophagus is free, the chances are that the foreign body is in the air-passages, though this is not absolute, as it may have been pushed into the stomach.

The differential diagnosis is extremely difficult, and the symptoms often present so much analogy that we are left in doubt for a long time.

Tracheotomy has been known to be performed in order to relieve the symptoms of suffocation produced by œsophageal foreign bodies which were thought to be in the larynx. Demarquay performed tracheotomy thinking that he had to deal with a foreign body in the trachea. A few days later, the child passed a pin in the stools, but death occurred in consequence of pneumonia. The possibility of a mistake of this kind should always be borne in mind, and, in order to draw the attention of the reader more strongly to this point, I will quote the following case, which was published in a London journal:

Observation.—Berry swallowed.—Difficulty of diagnosis.—A child swallowed a berry with the prickles attached; croupal cough. The foreign body was found to be in the upper part of the œsophagus. The child was made to swallow five or six pieces of softened bread, and stated each time that he felt the foreign body descend. After five or six acts of deglutition, all difficulty had disappeared, and the surgeon thought that the foreign body had fallen into the stomach. The cough continued, however, and an emetic was administered which gave rise to the expulsion of a few prickles. Temporary relief; relapse, and after six months of alternating health and disease, a broncho-pneumonia supervened. Symptoms of suffocation; danger of death; orthopnœa. Vomiting of bile and mucus then occurred, and the foreign body was expelled. (The London Med. Record, and Union médicale, 1876.)

I think that the perusal of this case will enable us to understand the difficulty of a differential diagnosis and the necessity of making a very careful examination.

Diagnosis of the Situation of the Foreign Body.—After having been convinced that a foreign body has entered the air-passages, the surgeon should, as I have remarked, endeavor to locate its exact situation. This examination enables him to determine whether the body is situated in the larynx, trachea, or bronchi. In order to arrive at such a conclusion, he must have an exact knowledge of the symptoms peculiar to each of these regions, and must make use of all the data furnished by the patient or those surrounding him concerning the nature of the foreign body and the initial symptoms, and he must especially rely on the results furnished by observation and exploration.

1. *Diagnosis of bodies arrested in the larynx.*—The following signs enable us to recognize the presence of the foreign body in the larynx or in the epi-glottic space. The bodies which are primarily arrested here are usually large, like pieces of meat, the mouthpiece of a whistle, a piece of carrot, etc., and the mere knowledge of their nature enables us *a priori* to assume that they have not passed through the glottis, on account of their size, and are situated in the epi-glottic space. The suffocation in such cases is sudden, and sometimes occurs silently when the obstruction is complete, and does not follow violent coughing spells. When, on the contrary, the initial paroxysm terminates suddenly in suffocation and danger of asphyxia, there is no doubt that a body, which was at first movable in the trachea, has become fixed in the larynx. Pain in the region of the larynx, which is either spontaneous or produced by slight pressure, is a sign of very great value, especially when combined with a sensation of peri-laryngeal resistance. But this pain is not a sign of absolute value, because it may persist for some time at a point in which the foreign body is no longer situated, either because it has been expectorated, or has fallen into the bronchi. To these symptoms we must add the harshness of the voice, the qualities of which change, the aphonia in some cases, nausea, the panting inspiration and expiration, with a valvular or stridulous bruit.

Finally, when all these symptoms are found united, we must make a direct exploration. Exploration is sometimes advised with the aid of the finger or another instrument, like a silver sound. But, as I have stated above, this manipulation possesses serious inconveniences, because it may be the cause of the penetration of an epi-glottic body. Meckren has quoted the example of a surgeon of his time, who pushed a foreign body of the pharynx into the larynx, an accident which caused the death of the patient. I am well aware that this class of cases has been opposed by that of Desault;[1] while performing catheterism he displaced a foreign body which obstructed the larynx, thus restored the respiration, and performed tracheotomy more readily. Apart from such a fortunate, accidental case, this practice can only give rise to danger, as it must always be performed blindly. We are not justified in performing laryngeal catheterism except in case of absolute necessity, if we cannot make a laryngoscopical examination, and if the intensity of the symptoms indicates immediate interference. This operation is always inferior to that of tracheotomy. For the past fifteen years the employment of the laryngoscope has permitted the recognition of numerous laryngeal foreign bodies, and not a year passes in which this valuable means of exploration does not furnish some brilliant success. It is beyond our province to describe this method of exploration, which will be found in special works on the subject. It has served to recognize pieces of bone which had been imbedded for a long time, fish-bones, pins, a leech, etc.

The employment of the laryngoscope almost always presents serious difficulties, as the introduction of the instrument will produce vomiting much more readily, since the region is already irritated by the presence of the foreign body. An American surgeon, Tool, states that he has remarked that, after each act of vomiting, there are a few seconds of respite, during which the fauces of the patient present a very remarkable insensibility and complete tolerance.

2. *Diagnosis of foreign bodies in the trachea.*—Foreign bodies in the trachea are either fixed or movable. The first are often very difficult of diagnosis, because they may not manifest their presence. We must, however, always except large fixed bodies, like Remy's and Gauthier's fishes, Perrin's piece of meat, which immediately produced serious and almost foudroyant symptoms. The physician rarely arrives sufficiently early to interfere, and the diagnosis, apart from the history, can only be retrospective. When the foreign body comes from without, the existence of a wound (ball of lead, needle, suicidal attempt, etc.) often points out the way to us. It is well known that a slight, insignificant pricking in the region of a slight wound of the skin of the neck put Lamartinière in the way of an exact diagnosis in a case in which a child had forced a pin from without inward into the trachea. He cut over the space in which the prick was perceptible and readily extracted the pin. There is usually no projection, although this is very frequent in cases of œsophageal foreign bodies. Finally, the laryngoscope may also render valuable services in expert hands in cases of fixed tracheal bodies. By the aid of the laryngoscope alone, Moritz Schmidt[2] succeeded in discovering a piece of bone which had been lodged in the trachea and in seizing it with the forceps through the natural passages. If the foreign body is movable, the symptoms are much more distinct, because the initial paroxysm is reproduced, at longer or shorter intervals, with the same characteristics and the same

[1] Œuvres, T. II., p. 253.

[2] Arch. für klin. Chirurgie, 1875.

array of asphyxial symptoms, spasm of the glottis, paroxysmal cough, cyanosed face, etc.

We must also add Zwinger's chattering bruit, the flapping bruit, heard at a distance and on auscultation, and the sensation of displacement noticed by the patient and by the hand of the physician when applied to the trachea. The fact of intermittence in the symptomatology alone suffices to characterize these movable foreign bodies.

3. *Diagnosis of foreign bodies situated in the lung.*—The diagnosis of the situation of foreign bodies in the bronchi is very often difficult. It only assumes absolute certainty in one case, viz., when a bronchus is completely obstructed by a solid body; and, furthermore, the accident must not have occurred at too remote a period, because the diagnosis is then one of the most difficult conceivable. If the object is not solid (tracheotomy canulæ, rings, irregular bodies, or those placed on edge), the determination of their situation is almost impossible, even at the beginning. I will successively review the three cases, which are very frequently presented in practice: 1, the foreign body solid and obstruction complete; 2, the foreign body admits the passage of air; 3, the foreign body is lodged in the bronchi for a long time.

1. *Foreign body solid and obstruction complete.*—Very fortunately this occurs most frequently, so that we can arrive at a very exact diagnosis. Sometimes there is an initial paroxysm, sometimes (though rarely) there is none. The clinical history furnishes the data in this respect, as well as with regard to the nature of the foreign body. The patient experiences pain and feels a very peculiar sensation, which he refers to the upper part of the chest. There are no paroxysms of convulsive cough as in the preceding cases; there is intense dyspnœa, and persistent oppression without remissions, as in emphysema. If we find both signs united, after having become assured of the introduction of a foreign body into the air-passages, we may affirm the localization of the foreign body in one of the bronchi. The diagnosis is rendered very precise in consequence of exploration of the chest. Resonance on percussion is usually preserved on both sides, but authors state that, in many cases, a dull zone exists corresponding to the region occupied by the object. Upon auscultation the vesicular murmur is heard throughout the whole chest, with the exception of an entire lobe, usually the median lobe, in which it is completely absent. The side of the obstruction coincides with that in which there is an absence of vesicular murmur. With the aid of these signs the diagnosis of these typical cases is easy.

2. *Foreign body, fixed or movable in the bronchi, and permitting the passage of air.*—In this variety, which is not rare, the preceding characteristic symptoms are entirely absent or lose their clearness. There is often an initial paroxysm; the oppression and dyspnœa may persist for a little while, but they present no peculiarity; there is no fixed pain.

The vesicular murmur, although a little more indistinct in one region, is heard over all portions of the lung; the resonance is normal. In the most fortunate cases, the passage of air into the space left free produces a peculiar bruit, sometimes stridulous, sometimes tremulous or sniffling, which may put us on the track of the diagnosis. The indication then is to reproduce the mobility or initial paroxysm by external manipulations in order to avoid, by relying upon a dangerous plan of expectancy, the asphyxia which the slightest displacement will produce. For this purpose, the thorax is suddenly moved in different directions and auscultation is performed at the same time or immediately afterward. The

changes thus produced may clear up the diagnosis in some cases, though not in all. As a rule, the chances are greater that the object will be situated in the right bronchus than in the left.

3. *Diagnosis of foreign bodies which have been lodged in the bronchi for a long time.*—In the course of this work I have drawn attention on several occasions to the frequency of the chronic symptoms which follow the presence of foreign bodies. Errors of diagnosis have been committed in almost half the cases, and the symptoms due to a foreign body, which had been unrecognized or forgotten for a long time, were attributed to pulmonary phthisis. There are undoubtedly circumstances under which we can have no suspicion of the real cause, because its similarity with cheesy phthisis is so great. Even the distinctive sign given by Bertholle is not of undoubted value. This author thought that the signs of phthisis were only present on the side on which the foreign body is situated, while the other is healthy. This is evidently a useful sign, but unfortunately it is insufficient in itself. We must also regard the antecedents, the profession, the more frequent presence on the right side and in the middle portions of the lung, the absence of heredity, etc., as isolated elements of diagnosis which may prove corroborative, though they possess no great importance.

Retrospective Diagnosis.—I have previously explained the meaning of this expression, viz., that the surgeon does not make the diagnosis until he has warded off the symptoms by tracheotomy. After the operation has been performed, he may immediately determine the approximate position of the foreign body by a simple manipulation. He introduces a canula, and the respiration will resume its normal course if the obstacle is situated in the larynx, while the symptoms persist if the foreign body is situated below. We acquire still greater certainty by temporarily withdrawing the canula, as the symptoms will then reappear if the foreign body is situated in the larynx. Apart from these considerations, the wound may be advantageously used in making an exact diagnosis. For this purpose a sound is introduced upward or downward, according as we suspect that the foreign body is situated in the larynx or trachea. But instead of this measure, the employment of which is not very useful and often produces suffocation, we prefer the examination with the tracheoscope devised by Voltolini, under the following circumstances :

Observation.—Hazelnut-shell discovered and extracted by the aid of the tracheoscope. —A child, ten years old, inadvertently swallowed a hazelnut-shell; the symptoms of suffocation were so sudden and threatening that tracheotomy was immediately performed. The operation relieved the symptoms of asphyxia, but the foreign body was not expelled. The voice did not resume its clearness, and the paroxysms of suffocation returned whenever an attempt was made to remove the canula. . . . Complete absence of pain for several months, but the child then complained of feeling a buzzing in the neck. In the course of the tenth month after the accident, Voltolini, having, on several occasions, made fruitless attempts with small laryngoscopes, devised a new instrument which he applied in the tracheal wound. This instrument, constructed on the plan of Brunton's otoscope, is provided with a magnifying glass. On the posterior wall of the trachea was found imbedded a mass as large as a lentil and exactly resembling a clot, except in consistence. Two weeks later Fischer, after having enlarged the opening in the trachea, withdrew from the canal a piece of shell fifteen millimetres long and twelve millimetres wide, which was imbedded so firmly that it was necessary to break it into three pieces before extracting it. Recovery. (Berl. klin. Wochenschr., 1875.)

This ingenious idea deserves to be taken into consideration and may render useful services in some cases. How often has tracheotomy not

relieved the patient, although the foreign body was situated very near the tracheal opening! In Triboulet's case, the shell of an apple-seed, which occupied this position, produced death despite tracheotomy. Such an error would be avoided by the use of the tracheal speculum. Schmidt has successfully employed small mirrors specially introduced into the tracheal wound. He was thus able to extract foreign bodies on two occasions. In one of them the patient was a girl who had cut the cricoid cartilage in order to kill herself and who wore a silver canula; a piece of whalebone, eleven centimetres long, which was used for cleaning the canula, fell into the trachea. Moritz Schmidt recognized its position with his mirror and readily performed extraction.[1]

By the side of these measures we may also place the use of the resonator for the purpose of discovering metallic foreign bodies, such as tracheotomy canulæ. In like manner, microphones or electrical explorers will be useful under such circumstances.

Differential Diagnosis.—More than all the others, the affections of the larynx may sometimes lead to error and deceive the patient. These include spasm and œdema of the glottis, stridulous laryngitis, croup, and syphilitic ulcerations of the larynx and trachea. But the history, the initial paroxysm, and the sudden development of the symptoms, are characteristic of foreign bodies. Spasmodic laryngitis is also remittent, but it is accompanied by fever, the paroxysm appears especially at night, and there are visible convulsions. It has been most frequently mistaken for croup. (René Blache, Triboulet.) Laryngoscopic examination will settle this question, as it will also with regard to ulcerations. Whistler has reported a case in which an ulceration of the larynx simulated the symptoms of a foreign body and was mistaken for it. By means of the laryngoscope, however, an ulceration half an inch long was found on the left ary-epiglottic ligament.[2] An exact diagnosis was also made in this manner in Johnson's case, in which a coin situated behind the larynx produced symptoms which partook both of a laryngeal and œsophageal character.[3]

CHAPTER XI.

TREATMENT.

The treatment of foreign bodies of the air-passages includes two great methods, viz.: 1. Expulsion and extraction through the natural passages. 2. Expulsion and extraction through artificial channels. The first method was the only one known formerly, but it had not by any means acquired the precision which it possesses to-day, thanks to the laryngoscope and to the perfection of our instruments. The second method, although of much more recent date, daily renders important services, so that it may justly claim to be considered the chief method in the treatment of foreign bodies of the air-passages. I will first describe the various procedures in each method and the results which they furnish in practice, reserving the consideration of the indications for a later period.

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[1] Langenbeck's Archiv, 1875, p. 186. [2] Lancet, 1876.
[3] Schmidt's Jahrbücher, 1868, p. 732, V. 138.

§1. Expulsion and Extraction through the Natural Passages.

1. Expulsion.—The measures whose object it is to cause the foreign bodies, which have been introduced, to make their exit through the mouth, merely possess an indirect action and are much less certain than the others. Some endeavor to produce violent expulsion, imitating nature in this respect; others utilize the action of gravity, and, at the same time, produce mobility and displacement of the object. Others, like emetics, cause disordered movements of the pharynx and larynx, and have been also employed.

1. *Coughing and Sneezing.*—Sternutatories formerly played a great part in the therapeutics of foreign bodies, and the insufflation of astringent substances or powders into the nares, producing coughing and sneezing, was never omitted. The violent shock produced by these means has proved useful in some cases, but at the present day they only possess an historical interest.

2. *Lubricators.— Oil.*—Since the time of Fabrice of Hilden the administration of infusions of marsh mallow and oil have replaced the preceding measures in great part. They do not act like the former; their object is to soften the parts, to relieve the contact of the foreign body when it is situated in the pharynx, and in all cases to diminish the irritation and the spasm of the glottis which is produced, though it is not easy to understand the *modus operandi.* This measure, although it has fallen into disuse, has proven useful even in our own times, as is very strikingly shown by the following case :

Observation.— Bean in the air-passages.— Usefulness of olive-oil.—Lasserre Lagen reports a case in which a bean had been introduced into the larynx, in which it gave rise to symptoms. The suffocation was relieved, as if by magic, by the administration of a spoonful of olive-oil. Whenever the symptoms reappeared, the same measure proved successful. Nevertheless tracheotomy was decided upon at a certain given time, but the surgeons hesitated before performing it, and continued the administration of the olive-oil. At the end of two weeks the foreign body was expelled in fragments. Recovery.

3. *Emetics.*—Emetics are recklessly administered whenever a person has swallowed a foreign body, whether it is situated in the œsophagus or air-passages. They are almost always useless in favoring the expulsion of bodies arrested in the latter region, and may, in some cases, even aggravate the situation, and bury the foreign bodies more deeply in the larynx. These measures have, however, sometimes succeeded, and we should not blame laymen who, in their impotency to do anything better, tickle the uvula by introducing the finger into the throat. However, these minor measures are rather temporizing methods employed by the laity and by apothecaries than by surgeons.

In addition to these measures, we must also refer to those whose object it is to utilize the weight and the greatest chance of expulsion of movable foreign bodies. This includes the treatment by position and percussion, which are almost always associated, and the results of which have been very often favorable, especially in slight cases. It is unnecessary to refer to the fact that whenever a person swallows "the wrong way," it is customary to strike him forcibly on the back, and that this practice is frequently attended with good results. The rational application of this method in surgical therapeutics constitutes a useful method, which it is well to remember and which may be always tried without inconvenience.

Some successful cases have become classical. The most celebrated ones are those of the English engineer Brunel, Lenoir, Duncan, Resieyès, and Hansford. B. Brodie has reported the history of the half-sovereign swallowed by Brunel, and I reprint from Malgaigne's Journal the following extract of this interesting case:

Observation.—Half-sovereign swallowed.—On April 3d, 1843, Brunel, while playing with some children, swallowed a half-sovereign which he had placed in his mouth, and a violent coughing spell, in which he appeared to be on the point of suffocation, was the result. Violent vomiting after this attack, followed by renewed efforts; during the night the cough returned at intervals, but without violence. A feeling of pain and tension in the fauces persisted for twenty-four hours. During the next two days he experienced little or no annoyance. The cough reappeared on April 6th, and increased on the 7th, in consequence of a cold; he expectorated mucus, which was slightly tinged with blood and contained small membranous shreds. Pain on the right side of the chest at a point corresponding to the lower part of the right bronchus. While vomiting on the 9th, he felt a displacement in the chest, and for a certain length of time afterward the cough was greatly relieved and the pain soothed. The cough persisted, and on April 18th the physicians diagnosticated the foreign body in the right bronchus. On the 19th this opinion was confirmed by a very simple experiment which Brunel had performed upon himself in the interval. He had placed himself upon his belly, the sternum resting on a chair, the head and neck inclined downward, and in this position he immediately had a distinct perception of a floating body, which glided forward along the trachea. This was followed by a violent convulsive cough. Upon standing up, he again had the sensation of a floating body which moved along the trachea, but in the opposite direction, that is to say, toward the chest. On the 26th there were no special respiratory symptoms. Brunel's experiment was then again attempted, but it only terminated in violent spells of coughing. On the 27th, sub-thyroid tracheotomy was performed. A few attempts at extraction did not even allow the coin to be felt; the introduction of instruments produced a convulsive cough. Further attempts on May 2d; renewed coughing spells. On May 13th the position which had been assumed was again employed, and the back was struck with the hand. Two or three efforts at coughing followed, and the patient suddenly felt the coin leave the bronchus, almost immediately afterward strike against an incisor tooth, and then fall out of the mouth. Expulsion of a small amount of blood. Rapid recovery.

During the same period, Lenoir obtained in France an even more astonishing success by this procedure; and, for want of a better method, we should imitate the conduct of this surgeon.

Observation.—Expulsion of a fifty-centime coin by means of position.—"A man entered the Charité, stating that he had swallowed a fifty-centime piece, and that he felt it in the back beneath the right scapula. Lenoir made him lie on the abdomen, the head being low, and struck with his hand upon the region in which the patient felt the presence of the foreign body, and at the same time asked him to cough. The coin was immediately disengaged, passed through the trachea and glottis, and escaped by the mouth, so that the patient was cured upon rising." (Jour. de Malgaigne, 1845, T. III., p. 55.)

Duncan's observation.—Expulsion of a shilling by position.—An individual was amusing himself by throwing a shilling in the air and catching it in his mouth, when the coin suddenly glided into the fauces and passed through the glottis. The accident gave rise to comparatively mild symptoms. The patient thought that he felt the coin fixed in the cricoid cartilage, and it appeared to him that he could displace it by standing on his head. As this idea coincided with Duncan's views, the shoulders were placed on a pillow, and the legs were elevated. After one or two shocks, Simpson rapidly carrying the larynx at the same time from one side to the other, the shilling passed into the mouth and fell on the floor. There was no coughing spell, no indication of dyspnœa, and the patient, being immediately relieved, was enchanted with the result. Recovery. (The Lancet, 1845.)

Halford, quoted by Holmes,[1] succeeded in expelling a shilling in the

[1] Holmes: Principles of Surgery, Vol. II., p. 363.

same way. Beneys also thinks that his patient's bullet would have been readily extracted if the head had been held low.

I have republished these few illustrations in order to show in what manner we must act in order to derive benefit from these special manipulations. Is there any danger in attempting them, and should they only be performed by a physician ?

Guyon answers the first question in the affirmative, and quotes Brunel's case as an example. But the other methods of treatment are no less dangerous, and either of them may, at any given time, produce spasm of the glottis.

I cannot, in any respect, share the opinion of this surgeon, who proscribed these manipulations as dangerous and of little use. It would be undoubtedly rash to claim that one method of treatment is applicable to all cases; but if we restrict ourselves to advising them as adjuvants before the arrival of a physician, they should be recommended, as they are not so dangerous as Guyon claims, since he has only quoted one case in which they were attended with bad results, while there are ten or twelve successful cases in literature. Moreover, the persons who are in attendance on a patient cannot abandon him to the mere resources of nature, and often to rapid asphyxia, without attempting something; and, of all these plans, position and percussion are the easiest and most effective.

The somewhat systematic opposition to these manipulations is based upon the seventeenth conclusion of Jobert, in which he stated that, even in the cadaver, foreign bodies which are propelled with a bellows furnishing a large column of air, experience difficulty in passing through the glottis. Sciance cannot draw any serious conclusions from such experiments which do not reproduce the normal conditions. Spasm of the glottis undoubtedly plays a very important part in the arrest of foreign bodies, but the arrangement of the larynx must also be regarded as an important consideration, as a foreign body may have difficulty in passing through it. If I am permitted to compare the opening of the glottis with the ordinary money-box, we will understand that an object coming from without may readily enter, while the exit is much more difficult. And I am inclined to this view still more strongly from the fact that silent asphyxia hardly ever occurs when foreign bodies of the air-passages are situated below the glottis; the air escapes at every moment, and thus proves that the glottis is not closed. If expulsion is difficult, it arises from the fact that a spasm of the glottis has narrowed the orifice, which is very poorly adapted to permit a passage. A modern author, writing on this subject, has stated that foreign bodies which are more than four lines in width have no chance of being expelled by the unaided efforts of nature, because their dimensions are then greater than the smallest diameter of the glottis.

Side by side with the treatment by position we must place that by sudden shocks and blows upon the feet. I only mention them for the sake of completeness, although these manipulations have obtained some measure of success. Gräfe observed a case in which a blow produced displacement of the foreign body, which fell back into the bronchus on the opposite side. In conclusion, all these palliative measures are useful, if we regard them as provisional plans, which should be employed while awaiting the arrival of a physician.

It still remains for me to mention the plan adopted by an English physician, Clifford Albutt, in a case in which a pill had fallen into a bronchus. This case, which presents great analogy with that of Donatus, is

even more singular on account of the chloroform narcosis which was intentionally prolonged for five hours. The following is a short synopsis.

Albutt's observation.—Pill in the air-passages.—Anæsthesia for five hours.—Expulsion of the pill in pieces.—An aconite pill, which had been administered in an attack of asthma, had been swallowed "the wrong way" by the patient. Clifford Albutt, being asked to attend the patient, found the respiration suppressed in the upper part of the lung; violent spasm of the glottis. Chloroform was administered for five hours, and at the end of this time half of the pill was expelled by expectoration and the rest followed in pieces. Thanks to the interposition of a cork between the teeth, the laryngoscope could be employed during the narcosis, and the vocal cords were found to be widely separated. (Brit. Med. Ass'n, Yorkshire branch, March 27, 1878.)

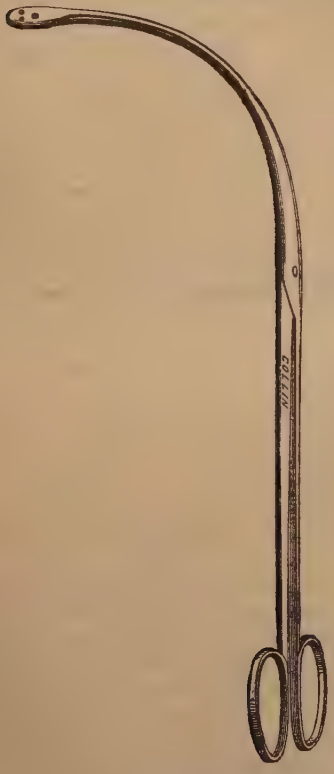

Fig. 29.

Fig. 30.

Forceps for the extraction of foreign bodies from the larynx.

Extraction.—Extraction through the natural passages is undoubtedly the most rational method, but it is rarely possible and always demands very great dexterity on the part of the surgeon.

It presupposes a management of the laryngoscope sufficiently familiar to permit manipulations upon the larynx with the aid of artificial light. The first successes obtained by this method are still very recent. In 1864 Gibbs detected a pin placed above the glottis and pricking the arytenoid cartilage, and relieved the patient.[1] In the chapter on diagnosis I re-

[1] Lancet, 1864, Vol. VII., p. 89.

ferred to Moritz Schmidt's case, in which he succeeded, in this way, in extracting a foreign body from the trachea. Mackenzie, Walker, Whistler have removed foreign bodies from the larynx with the aid of the laryngoscope. With the aid of Mackenzie's curved forceps Walker removed a clincher-nail from the glottis of an infant three months old. The spasm of the glottis was so great that it was necessary to pass the head of the nail sideways through the opening of the glottis, as a button is passed through a button-hole; the patient recovered.[1]

In Whistler's case the foreign body was a very large bone which had been present for five weeks; spasm of the glottis. On account of the enclosure of the foreign body, it was necessary to make a large number of attempts at lighting it up with the laryngoscope and to employ a small hooked sound, acting from behind forward. Recovery promptly occurred. The object was the ethmoid bone of a sheep, nearly an inch long and three-quarters of an inch wide.

Sometimes forceps are employed, sometimes hooks; the latter possess the disadvantage in some cases of acting with too great force, and they involve the risk of breaking the foreign body into two pieces, which may

Fig. 31.—Forceps for the extraction of foreign bodies from the larynx or trachea.

fall into the trachea. This accident, the consequences of which may be disastrous, occurred to Mackenzie in a case quoted by Whistler. In a case in which a bone was imbedded transversely between the ventricles, this able surgeon extracted a piece of the foreign body with a polypus forceps three days after the accident. He was, however, unable to extract the imbedded portion. It became necessary to perform tracheotomy a week later. With the aid of the laryngoscope, Mackenzie introduced underneath the foreign body a blunt hook, which he withdrew; the bone broke in the middle, and he succeeded in removing the fragments separately.

We should avoid too strong tractions in such cases, and I believe that it would have been much more preferable to slit the tracheal wound upward and to withdraw the foreign body directly from the bottom of the wound. The hook also succeeded in the hands of Tobold,[2] of Berlin, who thus extracted, a piece of bone which had been lodged in the left ventricle for five days; he did not succeed until the second attempt. Masséi, of Naples, removed a leech from the larynx by employing the laryngoscope.

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[1] Lancet, 1878.

[2] Gaz. médicale de Paris, 1872, p. 192.

Observation.—Leech withdrawn from the larynx.—A robust man, æt. 33 years, had a violent cough, dyspnœa, dysphagia, nasal voice, sputa of pure blood. These symptoms had existed for fifteen days, since the patient had drunk some brackish water from a marsh. On inspection of the pharynx, nothing was observed beyond hyperæmia. The laryngoscope enabled him to discover a leech on the right side above the aryteno-epiglottic ligament. Hence the cough, dyspnœa, dysphagia, and redness of the laryngeal mucous membrane; two pricks of the leech upon the epiglottis. With the aid of the laryngoscope and a polypus forceps, a live leech was extracted, after two fruitless attempts. The leech was four centimetres long. (Extract from Schmidt's Jahrbücher, 1876, 170, p. 271.)

There are few cases which testify more strongly than the following one to the advantage to be derived from the laryngoscope in skilful hands. By the aid of its light Oertel succeeded in removing a rubber plate containing false teeth from the orifice of the larynx.

Observation by Oertel, of Munich.—Extraction of a plate containing four teeth, by means of the laryngoscope.—An artificial set of teeth had remained for four weeks in the posterior part of the larynx before a laryngoscopic examination was made. The patient had been treated during this entire period for a diphtheritic inflammation of the larynx and pharynx. The upper part of the larynx was reddened and swollen; these signs appeared to diminish toward the interior of the organ. There was an accumulation of bloody mucus and pus in the sinus of the glottis; at each movement of deglutition, bloody and frothy mucus appeared between the epiglottis and posterior wall of the pharynx. Improvement under nitrate of silver and vapor of water, but the violent pains during deglutition remained the same. Five days later, Oertel discovered, with the laryngoscope, a white tubercle, as large as a lentil and covered with blood and pus, to the left of the epiglottis. A few days later, after the patient could tolerate catheterism, it was found that the tubercle was hard and immovable. An attempt

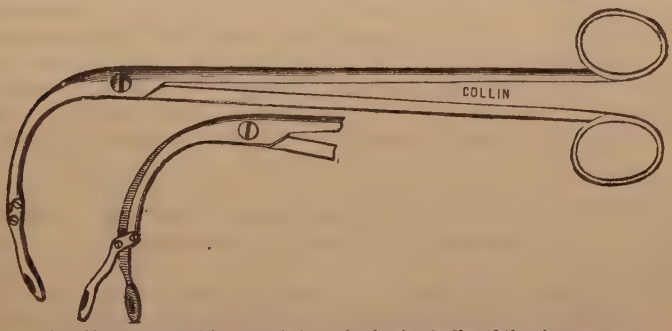

Fig. 32.—Forceps with movable lever for foreign bodies of the air-passages.

was made to remove it with a pair of forceps, but it slipped. With sponges and forceps Oertel removed the mucus which had accumulated in the depth, and he discovered two similar tubercles on the right side, and very close to the larynx, in the region of both arytenoid cartilages, a brownish-red, thin, uneven mass, which surrounded the entire larynx. With the aid of forceps, opening from before backward, he readily extracted this mass and removed it without the employment of force. The foreign body proved to be a rubber set of teeth (forty-two millimetres long, twenty-three millimetres wide, and thirteen millimetres high). The molar teeth were the three tubercles which had been seen on both sides of the epiglottis. (Schmidt's Jahrbücher, 1868, T. CXXXVIII., p. 282.)

How can we explain the slight favor which extraction with the aid of the laryngoscope enjoys in France? Krishaber[1] recently, after having recognized a foreign body in the larynx with the aid of the laryngeal

[1] Annales des maladies de l'oreille et du larynx, May 10, 1878.

mirror, refrained from using the instrument to perform extraction, because he thought that there are serious inconveniences in operating upon certain bodies, while sitting, as they may fall between the lips of the glottis. Extraction may be performed in these cases without using any illumination, as in the following example:

Observation.—Copper-plate in the larynx recognized by the laryngoscope.—Extraction without illumination.—A little girl, nine years old, while playing, inspired a little plate of copper which she held in her mouth, during a fit of laughter. She was immediately seized with cough and a very intense pain, which was referred to the laryngeal region. The presence of the foreign body in the air-passages was undeniable. An emetic had been administered, but produced no effect. I saw the child six hours later; respiration was not noisy, but rapid and interrupted. The voice was abolished; a slight incessant cough revealed the existence of a local irritation, but there was no spasm, properly speaking. I examined the child with the laryngoscope, and immediately detected the presence of a shining metallic body in the cavity of the larynx as high up as the vocal cords. It was a little plate, the mate of which was shown me by the relatives, and proved to be one of the small copper ornaments which are found on certain Algerian stuffs. The plate had the shape and dimensions of a twenty-centime piece, but was much lighter. I made the child lie upon the belly, across the bed, in such a way that the head lay over the edge of the bed, the face being turned to the ground, and I kneeled before her. With the index finger of the left hand I penetrated to the vestibule of the larynx, turning the epiglottis forward and flattening it against the base of the tongue. I thus made a free passage for a very narrow laryngeal forceps, which I introduced with the right hand, and with which I was able to seize and extract the object. Immediate recovery.

We must, therefore, place extraction without illumination by the side of extraction with the aid of the laryngoscope, but the diagnosis can only be made carefully by the aid of the former exploration. This is undoubtedly a useful method, but I do not think that it is free from inconvenience, and it appears to me that the introduction of the finger into the ventricle of the larynx presents some dangers, among others that of introduction into the glottis, so that the "so to speak infallible security," of which Krishaber speaks, may prove very dangerous to the patients.

§ 2. Expulsion and Extraction through Artificial Channels.—Tracheotomy and Laryngotomy.

For the purpose of favoring the expulsion and extraction of foreign bodies, the surgeon has opened artificial channels to the antero-superior part of the air-passages, in which the canal is superficial and accessible without too great danger from the action of instruments. Section of the trachea has also been performed in order to procure rapid relief to the severe symptoms of asphyxia produced by the presence of foreign bodies. In discussing the special indications of these operations, I will return to this point. The two operations performed upon the air-passages are laryngotomy and tracheotomy, to which the ancients wrongly gave the name bronchotomy. The employment of the latter measure is much more general than that of the former, and responds to much more varied indications. However, as diagnosis becomes more precise, we will resort more frequently to laryngotomy, which has not been performed a large number of times.

1. Laryngotomy.—By the term laryngotomy we mean the opening of the air-passages between the hyoid bone and the first ring of the trachea. The operation is direct when it involves the thyroid cartilage alone or at the same time with the other parts. It is indirect, on the contrary, when

the thyroid is not cut, and the opening is restricted to the adjacent membranes or to the cricoid cartilage. It is useless to recall the numerous varieties included in these two groups. They are based upon the size of the incision, their horizontal or vertical direction, and have been carefully described by Planchon[1] in his inaugural work, to which I refer the reader. Among fifteen cases, direct laryngotomy was performed eleven times, and indirect laryngotomy only four times; but it is more than probable that a considerable number of the latter cases have not been reported. In fact, indirect laryngotomy is always a secondary operation, which is performed after tracheotomy in order to afford light and permit the action of instruments.

Whatever may be the method employed, the object of laryngotomy is to give the surgeon access to the interior of the larynx in order to extract a foreign body which is fixed there. If we wish to extend its indications still further, it no longer possesses the same utility; and among the operations which have been performed, there are many in which it should have been omitted. Strictly speaking, the opening made into the larynx may permit expulsion; but this is a rare and uncertain termination, and in such cases it is much better to perform tracheotomy.

The operation in itself presents no difficulties. The larynx is fixed, and the integuments are held in the left hand while the bistoury cuts the superficial parts longitudinally down to the thyroid cartilage. The rule is not to touch the thyroid until it is certain that all discharge of blood has ceased. The surgeon then incises the thyroid cartilage along the median line, and this is done by small successive cuts without immediately penetrating the cavity of the larynx. After division of the thyroid, we come in contact with the muscles and mucous membrane which are divided in the same manner. At other times surgeons advise puncture of the crico-thyroid membrane and incision from below upward or upon a grooved director; but this expeditious method carries with it the danger of producing suffocation and convulsive movements of the larynx. The incision does not always involve the median line, a fact which may be attended with disastrous consequences in regard to phonation. By separating the two wings of the thyroid cartilage, the surgeon obtains sufficient space to enable him to explore the larynx, and, to a certain extent, the first rings of the trachea.

Pelletan, who first performed laryngotomy, pushed into the pharynx a piece of the tendon of a calf which obstructed the larynx.

Observation.—Laryngotomy.—Recovery.—In 1788, a man, about thirty years old, was brought to Pelletan; he had swallowed a piece of a calf's tendon "the wrong way;" the tendon was of a cylindrical shape, an inch long, and as large as the little finger. The accident had happened three days previously, since which time the respiration was noisy. The patient could not swallow without giving rise to a convulsive cough with immediate suffocation. Thyrotomy was performed in preference to tracheotomy, because there was marked flattening of the thyroid cartilage. After incision, Pelletan introduced his little finger into the cut and withdrew it without having felt anything. The patient feared that the foreign body had been displaced, and stated that he felt inclined to swallow. A sponge, being fixed to the end of a piece of whalebone and introduced through the mouth, forced it into the stomach. Immediate relief; recovery. (Pelletan: Clinique chirurgicale, T. II.)

Since the time of Pelletan, this manipulation has been imitated by Smith. A drunken shoemaker had swallowed a half-crown, which had

[1] Th. de Paris, 1868.

fallen into the larynx. He was cured by laryngotomy, the coin having been pushed into the mouth and expelled in this manner. The foreign body had been disclosed by the laryngoscope.

In cases of enclosure or fixation of the foreign body, it is much easier, thanks to the incision, to detach them through the latter than through the glottis, either with or without the use of the laryngoscope. In addition, thyrotomy may become necessary even if the body can be grasped through the mouth. Nothing serves to show the truth of this statement better than the case reported by Blandin.

Observation.—Needle in the larynx.—Laryngotomy.—A man, æt. 25 years, swallowed a needle threaded with coarse thread; traction useless; movements of pharynx distressing; voice almost extinguished; remarkable hoarseness; intermittent cough. The patient carries the hand to the left side of the larynx, where he experiences pain. Traction upon the thread useless; during a movement of deglutition the thread is carried into the pharynx, and can no longer be drawn outside.

The distress increases under the expectant plan; three days later, the thread is forced outside; fresh tractions fruitless; traction was then attempted with the aid of Belloc's canula, but with no greater success. Blandin discovered that the tube of the canula came in contact with the needle under the ary-epiglottic fold. Laryngotomy; puncture of the crico-thyroid membrane; section of the thyroid on a grooved director. A polypus forceps, which was twice introduced, produced a great deal of pain and did not remove the needle. On the day after the operation, a blackened needle, nineteen lines long, and looking as if it were bronzed, was found in the compress covering the wound. Recovery seven days afterward; the voice was gradually restored. (Journal hebdomadaire de médecine, T. I., 1828.)

I will compare this with another case which is equally interesting, because, under almost analogous conditions, the surgeon performed a successful pharyngotomy.

Observation.—Threaded needle piercing the arytenoid cartilage.—Pharyngotomy.—Recovery.—A robust farmer, thirty-four years of age, entered the Dublin Hospital. From his mouth hung a black thread attached to the ear. Two days previously, as he was trying to sew on a button, and was holding the needle in his mouth by the point, it slipped backward, and he made vain efforts to extract it with the thread. On laryngoscopic examination the needle was found to be fixed obliquely by the eye into the left palato-pharyngeal arch and by the point into the arytenoid cartilage. Deglutition was impossible, and grave symptoms were presented on the part of the larynx. After all attempts had proven fruitless, Wheeler determined, on the third day, to perform pharyngotomy. He made an incision on the left side, extending from the hyoid bone to the upper border of the cricoid cartilage; then, after having cut layer by layer upon a grooved director, he exposed the internal and external carotids, the superior thyroid artery, and the laryngeal nerve. After having cut the insertion of the omo-hyoid muscle, he introduced, through the mouth, a wooden stick into the pharynx, and then made an incision sufficient to introduce the index-finger upon this projecting portion of the pharynx. He did not at first succeed in reaching the foreign body with this finger; but he grasped the thread, and, thanks to this guide, finally reached the needle and extracted it. Recovery was complete at the end of twenty-six days. (Med. Press and Circular, April 22, 1875.)

When employed as a method of simple expulsion, thyroid laryngotomy will not succeed when the foreign bodies are fixed in the bronchi, and I cannot understand why Marjolin[1] and Armstrong[2] should prefer this operation to tracheotomy in such cases. The accident had disastrous consequences, which could not be attributed to the thyrotomy, as the foreign body obstructed the right bronchus. It is useless in such a case to involve an organ whose functions are important. Maisonneuve, in an

[1] Dict. de méd., art. Bronchotomie. [2] British Med. Journal, 1862.

analogous case, thought that the foreign body was in the larynx, but did not find it there. But on the following day the foreign body, having become movable, was expelled upon separating the edges of the cartilage. In Vital's, Martin Coates' (nickel penny),[1] and Berr's[2] (bone enclosed in the larynx) cases, on the contrary, the indications were clearly defined, and the operation was extremely useful. I will also mention Vital's very curious observation as an example, because it referred to a leech fixed in the larynx, which had been unrecognized for a long time, and which this learned military surgeon of the province of Constantine discovered and extracted with commendable boldness.

Observation.—Vital's case (Gazette médicale, 1838).—*Leech in the air-passages.—Laryngotomy.—Recovery.*—A soldier of the foreign legion, twenty-five years of age, had had bloody sputa for a month, and coming on suddenly after having drunk from a public fountain in Africa. A quarter of an hour after drinking, he had felt very sharp pricking in the fauces, distress, and had passed blood in mouthfuls. The disease was regarded and treated as a pulmonary affection, but without success.

The attention of the patient having been called to the possible presence of a leech, he remembered that the fountain had contained a number of filiform leeches. He studied his sensations, and stated on the following days that he felt the windings in and out of the leech in the trachea. An operation could alone relieve him. Desault's operation for laryngotomy was performed forty-six days after the beginning of the symptoms—this operation being regarded by Vital as far superior to other methods when performed on account of foreign bodies. Incisions of the integuments an inch and a half long, from the hyoid bone to the cricoid cartilage. The cervical aponeurosis was cut upon a grooved director, and the angular projection of the thyroid cartilage then appeared. The crico-thyroid space then came into view; the crico-thyroid artery was lowered with the nail, and the membrane perforated with a very sharp bistoury. The same bistoury (not probe-pointed) then divided the cartilage in the median line. Very little blood escaped, and it only remained to separate one wing of the divided thyroid from the other. This little manipulation, which is so simple in the cadaver, presents some difficulties. It is probable that the resistance is due to the passage of the sterno-thyroid muscles, each of which covers half of the cartilage on its own side, and to the attachments of the sterno-hyoid and thyro-hyoid muscles which maintain the halves of the larynx in position on account of their contraction. However this may be, the handle of a scalpel was introduced into the cartilaginous section, and served to separate the edges about four lines. The introduction of a forceps into the wound proved useless. A minute had not elapsed when a forcible expiration drove some mucus, stained with a little blood, through the wound, and a large leech sprung out in its midst. The latter was seized with the thumb and index finger, but it continued to adhere by the two ends to the tracheal mucous membrane, and it required a very strong traction to remove it. This was followed by marked relief. Two points of suture were placed in the lips of the wound. The patient immediately uttered a few words, and the voice was clear; he experienced no suffering. On September 24th a pouch of air formed in front of the wound, but a slight incision with the lancet sufficed to make it disappear. Two days afterward the cicatrization was complete. The patient had entirely recovered by October 11th.

The operation has rarely been performed immediately. In Armstrong's case alone it was performed on the day after the accident. In the others it was twice done on the third day, once on the fourth, on the sixth, etc. Finally, it was delayed in Vital's case (forty-six days), and in Berr's, in which it was not performed until seven weeks after the accident. The results obtained by direct laryngotomy are not unfavorable, as no death occurred except in Marjolin's case, in which the fatal issue was not due to the operation. Despite the section of the thyroid cartilage, which directly involves the vocal cords, in four cases at least the voice did not lose its integrity. In some cases, it is true, hoarseness de-

[1] Brit. Med. Journal, 1865.

[2] Aerzt. Intell., 1860.

veloped; the voice of Blandin's patient remained muffled. In fine, the reproach cast upon this operation is not justifiable, as the functions of the organ are not more compromised than in extraction through the natural passages. I know of some cases in which the surgeons have waited a long time in order to perform extraction through the pharynx, avoiding thyrotomy in order not to wound the vocal cords; their patients were aphonic after the extraction.

Indirect laryngotomy is usually not performed, as I have previously stated, except as an operation supplementary to tracheotomy. Charles Bell was the only one who made merely a horizontal incision through the crico-thyroid membrane.

Observation.—Plum-pit extraction after section of the crico-thyroid membrane.—A child, nine years old, swallowed a plum-pit while laughing. Suffocation; very labored, sniffling respiration. Incision of the integuments over a space three centimetres and a half long, on a level with the cricoid cartilage; section of the greatly dilated thyroid veins. The point of the scalpel was introduced between the cricoid and thyroid cartilages. Expulsion of mucus. A stylet, which was introduced into the larynx, did not come in contact with the foreign body. Nothing could be felt below, but threatening symptoms of asphyxia developed; these could only be dispelled by introducing a rubber catheter into the trachea. On renewed exploration the object could be felt in the trachea. Bell enlarged the incision in the membrane downward, bent a stylet in the shape of a hook, introduced it underneath the foreign body, and carried it very close to the opening in order to seize it with dressing forceps. Recovery. Normal voice. (London Medical Gazette.)

Tracheotomy would undoubtedly have been as strongly indicated as the preceding operation; but this does not hold good when the body is fixed in the larynx and cannot be extracted through the fauces. An operation of this kind has been recently performed at a late period by West, for the purpose of extracting a shilling which had lodged in the larynx.

Observation.—Case of laryngo-tracheotomy.—A young man, twenty years old, swallowed a shilling, which lodged in the larynx. Symptoms of suffocation, which were relieved and gave place to distress, and difficulty in swallowing, lasting a month. At this time a sniffling bruit was produced in the chest, with cough and dyspnœa. The foreign body was rendered movable, and the patient could feel its movements in the trachea; he could only lie upon the left side. His sleep was disturbed at night; the general condition was not very bad. He experienced a sensation of weight in the middle part of the sternum. Inspiration sonorous; expiration whistling; râles throughout the entire chest; bruit of tracheal whistling. In the beginning of the fourth month the symptoms increased, especially the dyspnœa. Laryngoscopic examination revealed nothing, but on the following day the coin was found at the level of the inferior vocal cords.

West, after having unsuccessfully attempted to remove the foreign body from above, made an incision three inches long, along the median line, upon the three upper rings of the trachea and the cricoid cartilage. He cut into the canal from below upward, introduced the finger, and felt the coin lodged in the tissues to the left of the cricoid cartilage. He enlarged the wound upward by dividing the cricoid cartilage and, after some effort, removed the foreign body with the aid of forceps; introduction of a canula and three sutures. Rapid recovery. (The Lancet, 1877, Vol. II., p. 722.)

If the foreign body has been extracted, we may bring the edges of the thyroid cartilage together after the operation, and leave the patient to himself. But if the body has not been extracted, and the symptoms of asphyxia reappear upon closing the wound, we must separate its edges and place a canula at the level of one of the membranes in order to facilitate respiration. We should then renew the explorations in the larynx,

because the foreign body is situated within it. But if the symptoms of suffocation persist despite the operation, it is evident that the body is lodged in the bronchi, and that the incision will prove useless until it has been rendered movable. This condition may be realized by a certain number of manipulations, which are also common to tracheotomy, and which I shall discuss under the latter heading.

2. Tracheotomy.—For more than two centuries tracheotomy has been performed a large number of times, and has given admirable results. But this operation was far from being readily accepted by surgeons, and I refer those who wish to obtain information concerning the changes through which the old bronchotomy has passed, and to the inconceivable resistance which characterized its beginnings, on the part of the surgeons of the seventeenth and eighteenth centuries, to Louis' treatise. It is hardly necessary to refer to the fact that a transverse incision was formerly made between two of the tracheal rings, and that, since the last century, surgeons have abandoned all timidity in order to enter boldly upon a new path which has proven fruitful in good results.

At the present day, with the exception of a few slight modifications in detail, tracheotomy is performed in the manner practised by Trousseau and Bretonneau sixty years ago. A longitudinal incision made below the cricoid cartilage successively divides the skin, aponeuroses, and vessels until the trachea is reached. When the flow of blood has been arrested, an inter-annular space is punctured with a bistoury, and an incision is made from below upward by means of a probe-pointed bistoury. The lips of the wound are kept separated by means of special dilating instruments, and the free passage of air is secured by the introduction of a canula into the wound.

This primary procedure, the performance of which always occupies quite a long time, has been replaced by several other more expeditious ones, the offspring of necessity. All are based upon the same principle, viz., simultaneous puncture of the integuments and of the trachea, but they expose the patient to greater risk of hemorrhage (Bourdillat, Chassaignac). For further details I refer to special treatises.

Tracheotomy with the cautery.—For several years past, the application of heat to operative surgery (galvano-caustic, Paquelin's cautery) has begun to modify the old methods, and the somewhat imaginary hæmostatic action expected from it has led to its employment in opening the trachea. Some only incise the integuments with the red-hot knife, while others cut through all these tissues into the trachea. As early as 1870 Amussat had operated with the galvano-cautery upon a child who had had a pebble in the trachea for a month. After the incision the child expelled the pebble in a fit of coughing. Since this operation, tracheotomy has been performed with the cautery a very large number of times; but from a recent discussion, in the Surgical Society of Paris, it appears that the flow of blood is not entirely arrested by it. Nevertheless, Verneuil,[1] Paulet, and Tillaux expressed various degrees of commendation of the operation.

Anæsthesia during the operation.—Should the patients be anæsthethized during the operation? This question cannot be definitely answered, either negatively or affirmatively. Aronssohn has laid down the rules which should guide the surgeon. He maintained that ether or chloroform should not be administered in cases of imminent suffocation,

[1] Soc. de chir., 1887, p. 262.

whenever the operation is performed *in extremis*. But these symptoms do not exist, or are not manifested with such intensity unless the foreign body is movable or is fixed in the larynx. We should, therefore, not anæsthetize the patient unless we are sure that the fixed foreign body is situated in one of the bronchi or in the trachea. But if primary anæsthesia presents some inconveniences, this is no longer true after a free current of air has been established by tracheotomy. In all cases in which the foreign body has not escaped, and in which manipulations are necessary, either for purposes of exploration or extraction, they are greatly facilitated, as I will soon show, by the insensibility of the tracheal mucous membrane, and anæsthesia may then render important services. It is hardly necessary to add that it is effected through the canula. According to West,[1] chloroform is always given in England, if the symptoms are not so urgent as to create a fear of imminent asphyxia.

Expulsion of Foreign Bodies after Tracheotomy.—The expulsion of the foreign body is the end sought for by tracheotomy, and one which is usually attained. Bourdillat found that spontaneous expulsion occurred 28 times among 80 well-observed cases of tracheotomy. Durham, in a much larger number of cases, found that among 554 cases of foreign bodies of the air-passages, tracheotomy was performed 167 times, in 91 of which spontaneous expulsion occurred. When compared with other modes of termination, this is the most frequent. But some distinctions must be made according as the expulsion is spontaneous or provoked, as it occurs through the tracheal wound or through the mouth, and, finally, according as it is late or early.

Early spontaneous expulsion through the wound is the most usual form of termination. Thus it was observed 62 times in Durham's 91 cases, and there are mechanical and physiological reasons which explain this circumstance. Favier had demonstrated, by a series of interesting experiments, that when foreign bodies were introduced into the trachea of a dog, they were expelled with great readiness through the gaping tracheal wound.[2] This is due to the fact that the artificial opening is not capable of contracting like the glottis, and that it always presents much larger and much more fixed dimensions. But one condition is indispensable for its production, viz., the previous mobility of the foreign body. It is also necessary that it be put in motion by the column of air which enters or emerges. In a word, it can only be expelled spontaneously during a paroxysm. When it occurs primarily, the expulsion does not usually wait a long time. The air has hardly entered the trachea when a fit of coughing is produced, and, in the midst of one of these paroxysms, the movable body is violently expelled through the edges of the wound which have been kept separated.

Late expulsion occurs in the same manner, and this is the usual manner of escape in foreign bodies which are temporarily fixed in the bronchi or trachea. They are not expelled until they lose their temporary fixity under the most variable influences. But it also occurs almost always in the twenty-four hours following the operation. The foreign body is found upon the dressing either on the following day or a few hours later.

Among the twenty-four cases of tracheotomy collected by Bourdillat, late expulsion occurred fourteen times, ten times within twenty-four hours and four times at a much later period. The latter cases are readily explained if we recall the final evolution of fixed foreign bodies of the tra-

[1] Lancet, 1877. [2] Acad. de chir., T. XIV., p. 447.

chea and bronchi which may become movable. In some cases it has not occurred until some months after the operation.

Expulsion by the mouth after tracheotomy occurred in twenty-nine cases among one hundred and sixty-seven operations collected by Durham, a figure which is less than half of that of the cases of spontaneous expulsion through the wound. Bourdillat has arrived at a similar result from his smaller collection: seventeen cases of expulsion by the mouth to eighty-two of immediate expulsion through the wound. It has sometimes occurred even during the operation or immediately afterward, sometimes a very long time elapses. It is very difficult to explain the good effects which an operation, performed upon the trachea, will produce upon the glottis. Prior to the operation, the latter is contracted and does not permit the passage of the foreign body, but, as soon as it is performed, the expulsion is readily achieved. There is no doubt that the diminution of spasm and the sedation produced by the free entrance of air into the air-passages, and the modifications occurring in the tracheal current of air, are not indifferent factors, though we are unable to explain how the favorable influence is effected. In one peculiar case, Dr. Sendler believes that he has found an entirely mechanical and very plausible explanation of the phenomenon.

Observation.—Coffee-bean in the air-passages.—Tracheotomy: expulsion through the mouth.—A roasted coffee-bean fell into the trachea of a child three and a half years old. The foreign body was felt to be movable in expiration and during cough. There was dulness at the base of the right lung, and mucous râles were heard during violent fits of coughing. The operation, which had been previously postponed, was performed on the fifth day. The section of the trachea was made to within half a line above the cricoid cartilage. At the moment that the attempt was made to introduce the canula, the coffee-bean was expelled from the mouth during a forcible expiration. Sendler thinks that the expulsion had not taken place previously, because, before incision, the air could not enter without causing the coffee-bean to descend into the bronchi, but that after the operation, on the contrary, the expiration, being performed through the larynx alone, had expelled the foreign body. The child was entirely cured in two weeks.

Under the term late expulsion through the mouth after tracheotomy, we do not refer to cases in which the expulsion has occurred after closure of the tracheal wound, as in the following case, reported by Rendu:

Observation.—Expulsion of a bean through the mouth after cicatrization of the tracheal wound.—A child, five years old, swallowed a kidney-bean. Convulsive cough; dyspnœa; improvement. Reappearance of the symptoms on the following days. Tracheotomy was performed, but nothing escaped from the wound, and the tracheal râle persisted. The wound was kept open for fifteen days, and then, being left to itself, rapidly healed. The paroxysms of suffocation reappeared. A discharge of very fetid muco-purulent matter occurred on the seventy-ninth day, in the midst of a very violent paroxysm. Repetition of similar symptoms on the following day, with expulsion of a black shell, formed of the epidermis of a bean and the germinated bean. Persistent paroxysms of convulsive cough and purulent sputa. Slow improvement. (Arch. gén. de méd., 4e Série, T. XXIV.)

It is evident that affairs would have terminated in the same manner if tracheotomy had not been performed, and this illustration cannot be placed in the same category with the others.

Finally, expulsion may occur shortly after the operation, or a longer or shorter period after special manipulations, the object of all of which is to produce mobility of the foreign body, and to make it pass either into the larynx or trachea, where it will be subject to the action of the air. In order to do this, several peculiar measures have been adopted by sur-

geons. The simplest of all consists in the production of cough, either by the introduction of a sound (Mazier) or of a feather into the tracheal wound. These instruments act sometimes, not alone by irritating the mucous membrane, but also by displacing the foreign body, as the following case tends to prove :

Observation by Marcacci.—Bean in the bronchi.—Tracheotomy.—Displacement with a feather.—A child, æt. three and a half years, swallowed a bean while playing. Followed immediately by cries, then by hoarseness. Nobody having witnessed the accident, the physicians suspected croup, and applied four leeches to the neck. The dyspnœa increased during the night; cyanosis, whistling at each respiratory movement. The relatives called Drs. Marcacci, Sr., and Marcacci, Jr. On the following day the physicians thought of the possibility of a foreign body in the larynx. Tracheotomy indicated. Dyspnœa continued, despite the operation. The foreign body was then situated below the larynx and the incision. The blood of a cut vein entered the trachea; paroxysm of dyspnœa. With a curved pair of forceps, clots of blood were thrice withdrawn. Marcacci, Jr., performed suction, and the child was placed head downward, but all in vain. A feather was introduced into the trachea for the purpose of stimulating respiration and cleaning the trachea. The feather was withdrawn, and the foreign body escaped. The condition of asphyxia persisted, despite artificial respiration. At the end of five or six minutes the first deep inspiration. The wound was closed, and the child recovered his voice. Recovery four days afterward. The author thinks that the feather had displaced the bean and carried it off. (Schmidt's Jahrbücher, 1876, Vol. 170, p. 271.)

Annandale made a little patient, who had a glass bead in the bronchi, take a deep inspiration, and closed the wound by introducing the handle of a scalpel into the trachea. This irritation produced a sudden expiration, and the foreign body was expelled at the second attempt.

Resort has also been had to the horizontal position, which, when added to percussion, favors displacement, to lateral (Pelletan) and abdominal decubitus, and to suspension; and an English surgeon [1] has recently insisted on the advantage of inclining the body, the anterior part upward, the head downward. It enables us to profit from the much greater width of the opening of the glottis anteriorly than posteriorly. All these measures may prove successful, and in some cases they have given good results in facilitating the expulsion of beans, pebbles, fruit-pits, etc. In the same category we must classify emesis, which proved very successful, in Benoit's hands, in employing it upon his own son. This surgeon performed tracheotomy with a lancet upon his child, who had swallowed a small mouthpiece of a trumpet. After the operation he introduced his finger through the mouth into the air-passages, and attempted to grasp the foreign body, which he could feel distinctly. Benoit did not succeed in these endeavors; he decided to tickle the fauces and produce efforts at vomiting, during which the metallic foreign body was expelled. He introduced three points of suture, and recovery was obtained in three days.

While the preceding minor manipulations only act indirectly others are addressed to the foreign body, and are directed at random or with precision. When the escape of the foreign body does not occur immediately or soon after the tracheotomy, it is recommended to search for it by introducing a soft catheter into the larynx, trachea, and even into the bronchi. This very often comes in contact with the foreign body and pushes it into the pharynx or trachea, as shown by the following example :

Observation.—Piece of carrot in the larynx.—Tracheotomy : expulsion into the pharynx.—A surgeon performed tracheotomy for a piece of carrot which had fallen

[1] The Lancet, 1878.

into the glottis. He introduced a dressing forceps into the wound until it reached the foreign body, threw the head backward, and succeeded in pushing the piece of carrot into the pharynx, from which it directly entered the œsophagus, and was swallowed. (Gaz. méd. de Paris, 1846, p. 234.)

For the sake of completeness, I will also mention another manipulation which has given good results in Bertain's hands:

Observation.—Tracheotomy for removal of a bean.—Intra-tracheal aspiration by means of a canula.—Expulsion.—Death.—A child had swallowed a bean, which promptly produced symptoms of suffocation, so that the operation of tracheotomy became necessary. The foreign body, although movable, was not expelled, and it could be seen moving through the tracheal wound. The surgeon then introduced a canula into the wound and made vigorous aspiration through this instrument. The bean was soon expelled by an active expiration, but the child died a few days later. (Gaz. méd. de Paris, 1844, p. 208.)

Fig. 33.—Collin's forceps for false membranes.

The Extraction of Foreign Bodies through the Wound.—Extraction after tracheotomy is a plan of treatment especially employed abroad, and deserves to be taken into consideration, as it undoubtedly renders great service. It has hardly come into general use for more than half a century, but it nevertheless counts numerous successes. Thus, it was performed 17 times in Bourdillat's 80 cases of tracheotomy, 14 of which were immediate and 3 late, and 39 times in Durham's 167 cases of tracheotomy. It is especially applicable to bodies situated below the wound, but also to those in the larynx.

Annandale succeeded in extracting through this passage, by means of curved forceps, a herring-bone fixed into the glottis, which projected into the pharynx, but the crook in which held it fast like a hook. It was necessary to make the foreign body project by introducing a finger into the pharynx. Despite the fortunate extraction, the patient died from exhaustion on the following day.[1]

Hitherto this method has been carried on somewhat blindly; but it will be greatly facilitated by improvements in the manner of illumination, and by those in the instrumental apparatus which still remain to be

Fig. 34.—S. Gross's forceps for extraction of foreign bodies from the trachea.

devised. It has remained primitive in the hands of surgeons who have been compelled to act promptly. In order to perform extraction, resort is usually had to forceps and hooks. The latter are especially useful

[1] Med. Times and Gazette, Feb., 1875.

when we can readily reach the foreign body which is not situated very deeply. Thus they are preferable in extracting bodies which are fixed near the tracheal wound, either above or below. But while the forceps necessary after the operation of laryngotomy are short and do not differ from those employed in dressing wounds, those used to enter the trachea or bronchi must be very long, with slight separation of the blades, and must unite solidity and lightness. Hitherto, these conditions have not been realized, and this is undoubtedly the reason that soft, malleable, flexible silver hooks are greatly preferred, as their shape and dimension can be immediately and voluntarily changed. J. Thompson successfully employed a metallic wire to remove a grain of corn and a piece of a pipe-stem an inch and a half long, which were engaged in the right bronchus. He extracted the latter in the same manner that a cork is withdrawn from a bottle. Finally, Roser (1877) advised the use of a ringed stylet. (Med. Doc. of Marbourg, July 11, 1877.)

J. Laidler was skilful enough to extract a piece of a metallic crayon-holder from the right bronchus by means of a long iron wire. He introduced the wire into the cavity of the foreign body, and then carried it as far as the tracheal wound.[1]

Edwards, of New York, had the good fortune, in a very difficult case, to feel the foreign body (a needle) which was fixed in the left bronchus, and extracted it with forceps. (N. Y. Med. Record, XIII., 7, 1878.) Thanks to these instruments, extraction has been resorted to for solid, annular, and tubular bodies; the latter furnish a considerable proportion of the cases.

Towbridge is one of the first authors who thought of employing a hook in order to extract a solid foreign body.

Observation.—Extraction of a bean by tracheotomy, and its disengagement by means of a silver hook.—A little girl, seven years old, presented symptoms following the introduction of a bean into the air-passage; an emetic had produced some relief after the expulsion of several beans; the cough, dyspnœa, and a pain at the upper part of the chest persisted. Towbridge doubted the presence of a foreign body in the bronchi until the symptoms reappeared during the night. Tracheotomy was performed on the following morning, but the bean did not escape. The introduction of a catheter into the trachea produced a slight hemorrhage, which put an end to further attempts. On the evening of the following day, Towbridge, who concluded from the symptoms that the bean was situated at the division of the trachea on the left side, took a silver wire, twelve inches long, curved it in the middle in the shape of a hook, introduced it from the right side, and then suddenly turned it to the left in order to grasp the bean, which he was thus enabled to withdraw. (Salz. Zeitung, 1820, T. 2., p. 363.)

House[2] reports that a piece of a metallic tracheotomy canula was extracted from the lung by means of long, curved forceps, in a case in which flexible hooks had failed.

Maunder has recently published a very curious example of extraction of an annular foreign body by means of a hook. The same plan should be adopted under similar circumstances.

Observation.—Extraction of a glass ring after tracheotomy by means of a silver hook.—A ring of polished glass had been swallowed, and had remained movable for fifteen days with all the usual phenomena. The patient felt it descend into the left lung, where it produced severe inflammatory symptoms. Tracheotomy was performed after anæsthesia. Treatment by position and percussion of the thorax having failed,

[1] Brit. Med. Jour., 1877.

[2] Royal Med. and Sur. Society, 1876.

a flexible hook of properly curved silver wire was introduced into the trachea. After two attempts, the foreign body, surrounded with mucus and pus, was removed. (Lancet, 1876.)

To these cases must be added the entire series which have been reported by House, Hulke, Clement Lucas, Burrow, West, etc., the majority of which are published in the Revue des sciences médicales, 1878, and which form examples of pieces of tracheotomy canulæ which have fallen by accident or by friction into the bronchi. With the exception of one case, they were all removed by hooks, and almost always a very long time after they had fallen into the trachea. Thus in Clement Lucas' case the silver canula had remained seven weeks before it was extracted. As all these cases present a certain analogy with one another, I will confine myself to publishing one which will serve as an illustration. It was reported by Hulke:

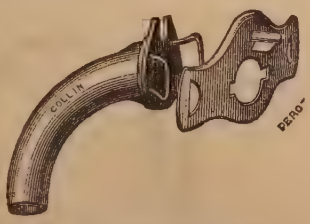

Fig. 35.—Tracheotomy canula.

Observation.—Tracheotomy canula fallen into the right bronchus (Hulke: The Lancet, 1876).—A woman, upon whom tracheotomy had been performed for a laryngeal affection, became the victim of a singular accident a week ago. While the internal canula was being replaced, after having been cleaned, the outer one slipped through the wound and fell deep into the lung. Some attempts were made to seize the canula with long, narrow forceps, but all these manipulations failed. All interference was delayed; the largest Trousseau's canula was applied, as the patient found it much less annoying than Durham's. She breathed quietly, and merely experienced some pain in the right lower half of the sternum. On the following days the cough became much more severe, as well as a pain in the left side; fever. Immediate extraction appeared to be the only means of rescuing her. After anæsthetizing her, Trousseau's canula was removed, and a long piece of silver wire was pushed through the wound to the bottom of the trachea. The precaution was adopted of bending one end of the wire in the form of a blunt hook, an eighth of an inch long; it was curved for an inch and a half in such a manner as to form an angle similar to that made by the bronchus and trachea. The other end of the metallic wire was held in a puncheon, which allowed traction to be made in the axis of the trachea. The canula could be distinctly felt, and, after having slipped the hook for a distance proportionate to the known length of the foreign body, it was slowly withdrawn, and, from the resistance experienced, it was thought that the tube was grappled. When it was near the tracheal wound, the hook went atrip, but the canula was readily seized with the forceps and withdrawn. Trousseau's canula was replaced and recovery occurred.

In conclusion, I will mention the excellent result obtained by Voltolini (quoted in the chapter on diagnosis) in the case of a foreign body fixed in the trachea, which was recognized by means of a special speculum long after its introduction and was extracted with the aid of forceps. This ingenious plan may render good services.

After-treatment.—Dressings.—In order to maintain order in our remarks on the usual course of the symptoms, I have placed all that pertains to expulsion and extraction before the remarks on dressing. The after-treatment depends, in fact, on the immediate result, and it varies a great deal according as the expulsion or extraction has caused the disappearance of the cause of the symptoms.

Presupposing that the foreign body has been rapidly expelled, what is the proper course to pursue? Must we, as some advise, leave the patient to nature and confine ourselves to a simple dressing of the wound in the neck? Or should we, as Bourdillat and Dupuytren, among others, recommend, introduce a canula or dilators, and keep the wound tempo-

rarily open? After having weighed the various arguments advanced by these authors, I believe that we should not be exclusive, and should allow ourselves to be guided in this respect by the symptoms. If blood has escaped into the trachea during the operation, and if this flow persists, we

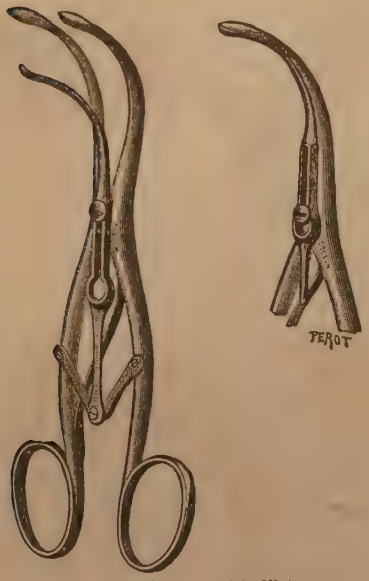

Fig. 36.—Laborde's dilator.

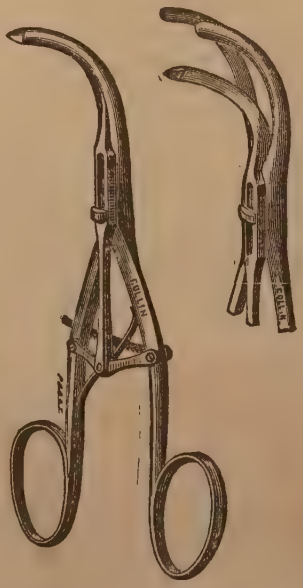

Fig 37.—B. Anger's tracheotome.

should introduce a tracheotomy canula of large calibre, as it is the best means of producing complete hæmostasis. It acts by regulating respiration and by compressing the orifices of the small divided vessels from without inward. But the introduction of the canula should not be prolonged immeasurably, and should not exceed a few minutes. Bourdillat also proposes to replace the canula by dilating forceps. In one case of hemorrhage, Robert ligatured the thyroid body *en masse* on each side of the incision. Apart from these considerations, if there is no escape of blood, we should bring the lips of the wound together, prefer secondary union to suture, and hold ourselves in readiness to introduce the canula again in case of accident. Usually recovery soon occurs.

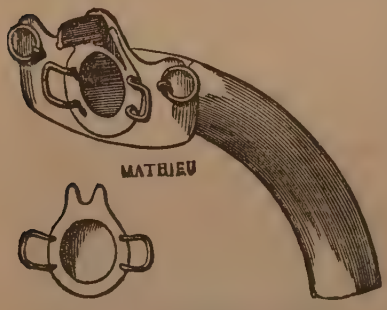

Fig. 38.—Double tracheotomy canula.

If the foreign body has not been expelled, the treatment is not the same, since we must not close the tracheal wound, as the symptoms of asphyxia may reappear at any moment, and especially as expulsion will be interfered with or prevented. It is the custom in such cases to place a canula in the wound. This precaution is sometimes insufficient. In fact, the foreign body engages with difficulty, and its engagement, when it

does occur, may reproduce the primary symptoms and endanger life. In Marjolin's case, quoted by Bourdillat,[1] the foreign body, a piece of glass, 0.025 long, which had not been extracted after tracheotomy, had engaged in the inner canula, and produced symptoms of asphyxia, which did not disappear until after the removal of the instrument. This case is the direct counterpart of one observed by Tatum,[2] in which the foreign body, a small pebble, was expelled through the tracheotomy canula; but this is merely a fortunate exception. Dilating forceps, and, still better, hooks and wires which keep the wound open, at least for a few days, should be preferred to the permanent introduction of a canula, which, in addition to the annoyances previously mentioned, also produces irritation of the trachea.

Some surgeons have advised, and Mitchell Henry has put the plan into practice, that the edges of the tracheal wound should be pierced by two silver wires, which are tied together at the back of the neck. Maslieurat-Lagémard employed small curved hooks attached to these wires.

Fig. 39.—Collin's tracheotomy tubes.

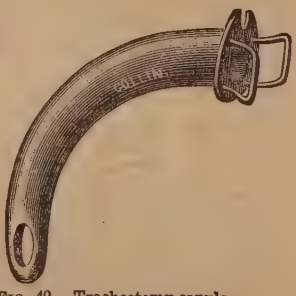

Fig. 40.—Tracheotomy canula.

These measures are useful, provided we adopt the precaution of covering the opening of the wound with gauze and place the patient in a room possessing a proper degree of warmth and moisture. If the foreign body gives no signs of mobility after a few days, we should remove the wires; if the respiratory symptoms are relieved, and there is nothing to make us suspect mobility, we should introduce an ordinary canula for some time, and not remove it until the spasm of the glottis has disappeared. After cicatrization has occurred, it is not rare to find the symptoms reappear and necessitate a second operation for tracheotomy.

Is it not better to allow the wound to close? The answer is very difficult, because there is nothing to make us believe in the future expulsion of the foreign body, and this is not always possible through the canula. I will briefly report a case of this kind, to which may be added the previously mentioned one by Corbet and Poulet.

Observation. — Tracheotomy performed twice. — Expulsion. — Recovery. — In Saint Bartholomew's Hospital, in London, Paget observed a young girl, æt. 11 years, who had swallowed a plum-pit "the wrong way" on September 2d, 1858. Tracheotomy was performed on the following day, but was not attended with a successful result. On October 8th the child had an attack of hæmoptysis. On the 16th recourse was again had to tracheotomy, care being taken to make the incision very large. The pit

[1] Gaz. méd., 1868, p. 180.

[2] Lancet, 1860.

was expelled during a spell of coughing, and the child was discharged entirely cured a week later. (Medical Times and Gazette, 1858.)

Results of Tracheotomy.—Accidents which may be produced by it.—The results furnished by tracheotomy are sufficiently numerous to enable us to draw certain practical conclusions, and the usefulness of this operation is perfectly evident. Among 554 cases collected by Durham, death occurred 42 times in 100 cases when the operation was not performed, while the proportion was lowered to 24 in 100 when the operation was made. In order to show this fundamental difference in another way, I will state that in 167 cases of tracheotomy performed for foreign bodies in the air-passages, recovery occurred in 130 cases, and death in only 37.

If we compare the gravity of the situation in which individuals who have a foreign body in the air-passages are placed with the excellent results obtained by tracheotomy, we will come to the conclusion that this operation is and will remain the most certain and effective treatment which we can adopt.

But, despite its undeniable advantages, tracheotomy is not free from all reproach and exempt from accidents, and among the 37 fatal cases in Durham's statistics some were due to the operation and others to the presence of the foreign body in the bronchi or larynx. In fact, the latter, by its presence, gives rise to lesions of an inflammatory nature which may also result from tracheotomy, so that we cannot determine with accuracy what part in the mortality is attributable to the tracheotomy alone. Everything leads us to believe, however, that its share is very small. The more intense and prolonged the symptoms prior to the operation (suffocation and dyspnœa) have been, the greater are the chances of the production of accidents and of a fatal termination from the tracheotomy, despite the expulsion and extraction of the foreign body. These conditions are not indifferent with regard to the production of hemorrhage and to the development of bronchitis [1] or pneumonia which are sometimes observed.

In certain cases the autopsy reveals multiple lesions. Thus, suppurative tracheitis and œdema of the glottis were observed at the same time; the patient died on the seventh day.[2] Hemorrhage has been the cause of death in several patients, both directly as well as from the extremely injurious application of the perchloride of iron [3] for the purpose of arresting it. It has sometimes been attributed to the action of the air alone, but this is only the result of imprudence.

Emphysema may also be produced, especially if the wound is very small, if sutures have been used, and if a very small canula has been employed. It was produced immediately after the operation which Warren [4] performed in order to extract a bean.

In Schuh's case[5] the emphysema appeared two hours after the operation, and involved the entire neck, the chest, and head; the air came from the mediastinum. He made the necessary incisions in the neck, and recovery was effected in twelve days.

I have already spoken of the means by which hemorrhage may be arrested. I am not an advocate of the plan of washing the wound with ice-water, as advised by West, or of the topical application of astringents. Torsion and ligature recommended for the arteries are much preferable.

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[1] Chever: Revue de Hayem, T. X., p. 264. [2] Lancet, 1871, T. II.
[3] Denucé: Soc. de chir., 1877. [4] Surg. Observations, Boston, 1867.
[5] Langenbeck's Arch., 1859.

The emphysema can be relieved by replacing a small canula by a larger one. We may enlarge the external wound by compressing the adjacent parts in order to expel the remaining air.

Finally, tracheotomy may also be a source of serious accidents if the tracheotomy canula is kept in situ for too long a period. West performed tracheotomy on a child who had swallowed a bone. The foreign body was not expelled after the operation, and remained fixed in the right bronchus. On account of its prolonged presence, the canula produced an ulceration of the trachea and perhaps of the inferior thyroid artery. H. Roger[1] had called attention to cases of this kind as early as 1859.

CHAPTER XII.

THE INDICATIONS TO BE FOLLOWED IN THE CHOICE OF A METHOD OF TREATMENT.

With regard to the treatment to be pursued, we must consider two entirely distinct cases, according as : 1, the symptoms are very severe and immediately endanger life ; 2, the symptoms are compatible with a more serious examination.

1. Cases of Imminent Asphyxia.—The first thing to be done when called to a patient who is suffocating from the introduction of a foreign body or from any other cause, is to endeavor to re-establish respiration. When it is not due to submersion, the best and most certain means consists in opening the trachea below the cricoid cartilage. This operation is simple compared with the dangers which the patient runs, and it may be performed with a pen-knife, bistoury, or lancet, as Benoit did in a case of necessity. Whitcombe succeeded in saving the life of a lunatic by cutting the trachea with a pen-knife, under circumstances in which the operation was very clearly indicated.

Observation.—Tracheotomy performed with a pen-knife.—Extraction of pieces of meat from the larynx.—A very gluttonous epileptic maniac frequently robbed the other patients of food and forced it hastily into his mouth, so that it had become necessary, on several occasions, to employ the œsophageal forceps. One day he had gluttonously swallowed a crust of bread while speaking, after which he fell and lay apparently dead ; the face was cadaveric, the lower jaw drooping, the pulse was no longer perceptible ; he manifested neither sensation nor respiratory movements. Whitcombe, who had no other instrument at his command, made an incision with a pen-knife into the trachea, sufficiently large to permit the introduction of the little finger, and removed two pieces of meat which were firmly fixed in the larynx. Artificial respiration was performed, and the respiration was soon restored. The patient finally recovered. (Whitcombe : Journal of Mental Science, XXII., p. 95, 1876.)

The treatment is entirely symptomatic, and the physician determines it from the diagnosis without being disquieted by the history. If the symptoms subside for a few seconds, he may evidently be enlightened by useful data ; but it is well not to temporize, as each moment compromises the results of the operation and increases the congestion of the neck. For various reasons tracheotomy is much more preferable in this case to laryngotomy. In the beginning we must act rapidly, and section of a few

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[1] Bull. de l'Acad. de méd., 1859.

rings of the trachea presents much less difficulty than section of the thyroid, which must be done carefully and slowly. If there is œdema of the glottis, mere section of the cartilage will not suffice to restore the current of air, and the symptoms reappear. Furthermore, we are then at a distance from the place in which the foreign bodies are most frequently situated, viz., the trachea, and we thus lose some chances of immediate expulsion.

1. Cases in which the Diagnosis may be made.—By means of all the signs enumerated in the chapter on diagnosis, the surgeon will obtain a certain precision in the determination of the situation occupied by the foreign bodies in the air-passages. In this respect, and especially with regard to treatment, we may classify all the special cases according, as : 1, the diagnosis remains uncertain ; 2, it is certain that the foreign body is fixed in the larynx ; 3, the foreign body is fixed in the bronchi ; 4. the foreign body is movable in the bronchi.

1. *The diagnosis is uncertain.*—This uncertainty obtains with regard to certain foreign bodies fixed in the trachea and even in the bronchi, which are placed on edge or are hollow, which do not prevent the passage of air, are not very irritating, and do not produce any symptoms. At first sight we would be tempted to leave these to themselves, especially as there are no primary symptoms ; but experience has taught that this is a dangerous plan, and that this period of deceptive calm may be followed by the most severe symptoms of asphyxia. Before performing an operation, we should by all means endeavor to render the foreign body movable, and for this purpose may employ percussion, position, make the patient rise or lie down, produce cough, sneezing, and, if necessary, emesis. If these attempts succeed, doubt is no longer possible, and we enter the fourth category, in which the foreign body is movable in the bronchi. But we must operate, even if these measures do not succeed, and tracheotomy is indicated in preference to laryngotomy. When the trachea has been opened, the surgeon can immediately assure himself of the permeability of the larynx, and does this by means of the introduction of a sound from below upward. This constitutes a sort of sweeping, after the manner of Guersant. But I cannot too strongly condemn the conduct of those surgeons who have not feared to perform this manipulation with their fingers, despite their dimensions and the symptoms which they may produce. The irritation produced by this sounding always produces very violent paroxysms of coughing, especially if the patient has not been narcotized. These paroxysms are useful because they aid the displacement of the body and may render it movable. If it nevertheless remain fixed, we must, however, perform the operation ; we can do this with so much less uneasiness because preventive tracheotomy wards off the severer accidents which may develop.

2. *The foreign body is undoubtedly fixed in the larynx.*—The surgeon has several plans of treatment at his disposition. The first and simplest is extraction through the fauces, by means of forceps or hooks, which may be either employed with the laryngoscopic mirror, or according to Krishaber's method. When this is not possible, or the foreign body is too firmly adherent, it is best to create a direct path for the instruments, and the surgeon may hesitate between three operations, viz., tracheotomy, laryngotomy, and laryngo-tracheotomy. The question as to which one shall be preferably adopted is very difficult to decide, and may vary according to the individual case. The shape, situation and weight of the foreign body, its real or supposed position, the age of the patients, the urgency of the

symptoms or their mildness, are capable of modifying the opinion. Nevertheless, in adults, to whom we refer at the present time, we should preferably resort to laryngotomy, which is a ready and safe operation, opens a large path for the foreign body, and facilitates the manipulations more than any other. It has been objected to as causing an alteration in the voice ; I have previously shown that this objection does not hold good in all cases. Tracheo-laryngotomy is preferable in children because the larynx is much smaller, and the incision of the first rings of the trachea and of the cricoid cartilage, which are comparatively superficial, is easy. The hemorrhage is less to be feared than when the operation is performed lower down, and the opening obtained affords an entirely sufficient entrance into the larynx, without compromising its functions.

3. *The foreign body is fixed in the bronchi.*—If all the symptoms indicate that the foreign body is lodged in one of the divisions of the bronchi, the indication for the operation holds good none the less. But we must previously endeavor, by all possible means, to render the body movable, as this is almost its only chance of being expelled. If this attempt does not succeed, we must perform tracheotomy as a preventive operation, similar to that for movable bodies in the trachea. After the operation has been performed, it is not rare to find that the coughing spells produced by the contact of the fresh air displace the foreign body, which is then expelled. This mobility can be greatly furthered by the introduction of a catheter or canula, and, if necessary, a hook as far as the corresponding bronchus. If the body is hollow, we should adopt the plan pursued by the English with regard to tracheotomy canulæ, and should endeavor to extract them with the aid of forceps or hooks. These measures are even capable of furnishing good results in cases of solid bodies.

4. *The foreign body is movable in the bronchi and trachea.*—In these cases, also, the preference should be given to tracheotomy. This is the opinion of the large majority of authors, though some prefer laryngotomy. Thus, contrary to the authoritative opinion of S. Gross, of Philadelphia, H. Lee prefers laryngotomy with inversion of the body. The first operation is much more certain, and the further manipulations, if they are necessary, are rendered much easier.

The Period at which the Operation should be Performed.—The period for operation is not doubtful whenever the symptoms are grave or the paroxysms occur in rapid succession, for we must then operate as soon as possible. If the symptoms give the surgeon any respite, he should employ it in clearing up the diagnosis, and should operate forthwith if the indication presents itself. Surgeons have lost their patients from a violation of this rule (which presents no exceptions), as the morrow may be too late. In the same way, if symptomatic tracheotomy has been performed, and the foreign body is in the larynx, it must be removed, as it may be displaced and become dangerous. This is proven by the case quoted by Sédillot in his *Médecine opératoire.* He had performed tracheotomy on a child for a bone situated in the larynx. Yielding to the advice of the consulting surgeons in attendance, he deferred the incision of the larynx until the next day, and in the interval the patient died of asphyxia.

The indications for the operation still hold good, even if the foreign body has been introduced for a long time, unless serious changes have occurred in the lungs, a fact which counterindicates the operation.

PART IV.—FOREIGN BODIES IN THE GENITO-URINARY ORGANS.

GENERAL ETIOLOGY.

The unusual presence of foreign bodies in the male and female genito-urinary organs is explained by extremely various causes, and it is necessary, for the sake of clearness of description, to group together those cases which possess a similar etiology. It would not be rational to confound in one study the foreign bodies which are introduced through the natural channels, that is to say, through the urethra, with those which have entered as the result of traumatism, such as bullets and splinters of bone. In like manner, simple calculi of the bladder or urethra do not constitute true foreign bodies, according to the general definition, because they are fully formed without the irritation of a nucleus having been necessary. This study, therefore, only involves those bodies which have been introduced into the genito-urinary organs, to the exclusion of those bodies which are of traumatic origin, and the history of which will be described at a later period. Those which have entered in consequence of some accidental communication with the adjacent organs do not merit special attention. I have previously entered into sufficient detail upon the mechanism of their migration, and, when they have once arrived in the bladder, they act like other bodies, are subject to the same laws, and pass through the same changes.

1. Foreign Bodies Introduced through the Natural Channels.—Some of these have a surgical or therapeutic origin, like catheters, bougies, pieces of instruments, etc.; others, and the more numerous class, have been accidentally introduced into the urinary passages by individuals who employed them as means of sexual excitement; finally, some, though a very small number, are due to mental aberration, suicidal mania, malice, drunkenness.

1. *Foreign bodies of surgical or therapeutic origin.*—If we throw a glance over the long series of bodies introduced through the urethra into the urinary passages, we will find that a large number of surgical instruments (catheters, bougies, etc.) figure in it, and that they have either been broken in the canal or bladder, or have disappeared in their entirety. At a not very remote period the catheters employed by surgeons in the treatment of affections of the urinary passages left much to be desired with regard to their construction and solidity.

It is only from an historical point of view, and to better mark the progress of contemporary manufacture, that I recall the numerous accidents attributed to lead sounds, to elastic, rubber, and gutta-percha bou-

gies, etc. In the last century Morand and his contemporaries had already drawn attention to the dangers resulting from the use of lead sounds, especially of those made roughly and manufactured wholesale. The use of such instruments has entirely ceased at the present time, and we can scarcely find any vestiges of this primitive era in the much better constructed patterns of Mayor or Béniqué. A little later, the introduction of caoutchouc in the arts, and then of gutta-percha, became the origin of a large number of accidents. Thus, about the year 1850, French and foreign journals teemed with cases of accidents occurring from the breaking of gutta-percha catheters. These cases were so much the more deplorable when they occurred in the practice of country physicians, who did not always have the instrumental resources of city physicians at their command in order to escape from their dilemma. Despite modern improvements these cases are not very rare, and Mercier drew attention, a few years ago, to the desideratum of perfect instruments.

But this variety of accident occurs much more frequently in individuals who have long been accustomed to catheterize themselves, and, through negligence or ignorance, employ imperfect, worn, and poor instruments. In one case an old man has emptied his paretic bladder for twenty years with the same catheter. Again, another sexagenarian, mentioned by Ségalas, used a catheter made of two pieces fastened together with a little sealing wax; one day half of it remained in the urethral canal. Can we wonder at the frequency of these accidents when we find an individual reckless enough to use a broken silver catheter which had been mended by the village watchmaker?

But at other times even the best-constructed instruments are liable to be broken, although we are unable to determine the reason. This has happened to lithotrites (objects made with great care by specialists who are justly jealous of their reputation), to porte-caustique sounds, etc. Hitherto we have only referred to fragments, but it is not rare to find whole instruments or large pieces in the deeper parts of the urethra. Though this accident usually occurs in inexperienced hands, we must remember that it may also happen to unskilful or careless physicians, and even under the simplest circumstances : witness the history reported by Chopart of a silver catheter which, being forgotten in the bladder of a woman three months pregnant, gave rise to severe symptoms. In another instance, a surgeon omitted the precaution of securing a catheter which was temporarily left in the urethral canal, and, on the following day, it had entered the bladder. This accident is very often observed in patients who have fallen asleep with the catheter in the canal, and who have not taken the precaution of securing it. Or perhaps the individuals have been accustomed to catheterize themselves with the most strange (usually very short) instruments, which slip from their hands. This happened to a citizen of Grenoble, who catheterized himself with a peculiar canula four and a half inches long. In order to enter the bladder he was obliged to introduce it very deep by driving back the urethra. One day the instrument escaped him during this delicate manipulation; he was unable to remove it, and could only be relieved by lithotomy.

I would never cease if I attempted to bring before the eyes of the reader the varied circumstances under which instruments used for therapeutic purposes have been arrested in the genito-urinary organs. The accident almost always results from a want of skill or care in the management of catheters in the unfortunates who are incessantly occupied with their urinary passages, as usually occurs in those who have some

acute or chronic affection of these organs. Nevertheless a large share must be attributed to chance or to circumstances independent of the will. Thus Birkett relates that a man of mature age had the habit of introducing a silver catheter, and of retaining it a certain time in bed. He fell asleep, and, upon waking, broke the catheter, half of which remained in the urethra and was extracted with forceps. This is not a unique case. I saw a similar accident occur to a soldier who simulated incontinence of urine, and whose bladder I explored in order to determine its contractility. At the moment that my silver catheter cleared the prostate, the man, from a motive which can only be determined with difficulty, suddenly seized it with his hand. Half of it remained in the canal, but it was only disarticulated, and I was fortunate enough, by pressing from behind forward, to extract it—the other portion being bent and flattened against the pubis.

2. *Foreign bodies of erotic origin.*—The reader will not have forgotten the monstrous histories, the scene of which was laid in the rectum, and he will remember the varied series of foreign bodies which old debauchees employed to satisfy their passion. I then showed how these depraved beings take advantage of the last reflexes of their genito-urinary organs in order to produce the venereal orgasm. Equally long is the list of foreign bodies introduced into the urethra for an unmentionable purpose by children, men, women, and old men, as the cases are counted by hundreds. All seek the same end, and draw upon the same artificial and unnatural source for the voluptuous sensations which habit has gradually blunted. In these individuals masturbation gradually becomes a mania, and when their organs, fatigued by frantic friction, refuse to obey their incessantly returning desires, they resort to more active means of stimulation—to rougher contact. In proportion as the natural sensibility diminishes, we find them pursuing and recalling it by stimulation, by means of foreign bodies, which they introduce more and more deeply into the canal of the urethra or vagina.

If we ask, in astonishment, by what bizarre peculiarity are these individuals impelled to such manipulations, we should recall the sentiments expressed by Montaigne when he says that "lust seeks self-stimulation even in pain."

Though the expression of the old moralist is coarse and harsh, it well shows the narrow boundary which unites pleasure, irritation, and pain by a gradual transition.

But, it is asked, why are these various foreign bodies, such as boxes, wooden rods, stems, pins, needles, lodged in the urethral canal? Why this chance which causes such a large number of them to disappear? For the individuals who are addicted to these practices adopt all the measures necessary to avoid a dangerous accident, which will draw attention to them and perhaps force them to make a reluctant confession of their shame. Some adopt a large number of precautions in order to prevent the escape of their favorite instrument. In many cases, pencils, or little sticks of wood were found attached to a wire at one end. But even these measures are not infallible, as we see, because the first cause which leads to the disappearance of the foreign bodies is physiological and unconscious.

Upon analyzing the hundreds of observations of this kind scattered throughout literature, and the confessions of many of the patients, we find that the largest number, at the moment at which the irritation produced by the repeated frictions realizes their desires, lose all knowledge

of their situation, forget the instrument of their passion in order to abandon themselves to the sensation which they have obtained at the price of such efforts. If I add to this the frequent and disordered convulsive movements, the momentary paralysis of the flexors which is almost always present, the condition of hebetude and exhaustion which terminates these solitary scenes, nothing is more readily understood than the introduction of these objects into the genital organs. The unfortunates relax their hold, and nature does the rest, when, after the paroxysm, she relaxes these exhausted and turgescent organs, carrying into their interior the forgotten foreign bodies.

When the victims of this brutal passion return to themselves, it is too late, and all the attempts made to withdraw the object only tend to force it in still further and to produce pain.

When once contained in the urethra, the strayed foreign bodies belong to pathology, and their history will be entered upon at greater length in the course of this work. Sooner or later these unfortunates, driven by pain, insomnia, loss of health, and at the end of their endurance, seek the relief afforded by our art. But they rarely adopt this resolution, which is carried out at such a cost to their self-love, at an early period. We also find that they are admitted into the hospitals in a dying condition, or, having arrived at the last stage of marasmus, enter the office of some practitioner. But the confessions, which alone can guide the conduct of the surgeon, are not frequent, and it is rare that the latter is not obliged to complete or correct the histories which are told him. While the patients resist their sufferings, they always expect from chance or from empirical measures a recovery which will spare them their confessions. Some drink large quantities of fluids, diluent drinks, oil, etc.; others endeavor to extract the lost object by incredible manipulations. Some individuals succeed. Thus an old masturbator employed for this purpose a watch-spring bent into an arched shape, with which he was able to remove a bean from the urethral canal. Some time afterward, while attempting to use the same apparatus to remove a garlic-hop, the spring broke, and he was unable to remove it with the aid of an iron hook, which tore the entire canal.

Another case refers to a monk, who had the boldness to perform perineal section upon himself in order to remove a key from the bladder, which, in consequence of his vicious practices, had escaped into that organ. Finally, some prefer to die with their secret, and it is not rare to find, upon autopsy, foreign bodies in the bladder which have produced the most serious disorders.

Though the patients sometimes tell their history frankly, they most frequently endeavor to deceive, either by lying with regard to the character of the foreign body introduced, or by giving strange explanations concerning the manner of entrance. Women are especially inclined to this manner of invention, and their subterfuges are almost always the same. The patients sometimes relate that, in order to relieve their pains and the pruritus which they experienced in the urethral canal, they thought it advantageous to rub it with some object. Others, in order to produce emission of retained urine, have endeavored to empty the canal, and thus endeavor to give to their mishap a therapeutical coloring. But all these accounts are falsehoods, which are very often exposed by a mere inspection of the genitals and of the nature of the body. How can we believe the story of the girl, who stated that, having experienced some difficulty in micturition, she had attempted, in accordance with the advice of

a midwife, to empty the canal with an etui which had fallen into the bladder. Upon exploring the urethra, the physician noticed that the finger readily entered, a phenomenon which could not occur if the canal had not been subjected to abnormal dilatation for a long time. It was also in order to empty the canal that a Capuchin monk stated that he had introduced the end of his girdle; a vine-dresser, the branch of a vine; and another man, the tube of a barometer.

The reason adduced by these patients has, at least, some semblance of truth; but this is not so of the remarkable accidents which have happened to some of them. In one case a girl was gathering ivy upon a tree, and, in falling, had forced into the bladder a little stick which some children had stuck into the ground while playing. Another girl seriously stated that she had slipped in school, while mounted on a desk, and that, in falling, she had alighted upon a pin-cushion. Again, a straw had entered the urethra through the clothes in falling on some stubble. Finally, such statements have even been made by men. One masturbator has been known to state that, during a fall, a pencil which he had in his pocket had penetrated the bladder. How true it is that the imagination of these depraved individuals is so poor in expedients!

There is still another explanation which serves as a theme for these masturbators. Some of them state that they have swallowed the foreign bodies either while playing or while endeavoring to produce emesis, and that they are inclined to think that they have passed into the bladder. This is the manner in which women have explained the presence of boxes, ivory needles, etc., in their genito-urinary organs, and in which a monk hoped by this pious fraud to deceive the sagacity of the surgeon who extracted a foreign body from his bladder. These reasons would, at the best, have some likelihood in the case of needles or other small objects, but the course of the symptoms is then very different from that of a body introduced into the bladder.

Foreign bodies of accidental origin and resulting from perversion of ideas.—The latter group, which does not include very homogeneous cases, includes all foreign bodies introduced through the natural passages, except those employed for therapeutic or erotic purposes. Almost all result from a temporary or permanent perversion of ideas, from malice, curiosity, stupidity, etc. The largest proportion of these cases are attributable to drunkenness, which, without extinguishing desire, greatly lowers the sensibility, and, by suppressing reason, impels the patients to the most irrational acts. At one time the case refers to a drunkard in whose urethra some drunken women introduced a bean; at another, a medal or a pin. If these cases are authentic, and some of them are proven, they are very well explained by the disgusting manipulations to which these lecherous women resort in order to reawaken the vitality of the genital organs of the male.

Drunkenness is also a very common cause, though it acts in a somewhat different manner. As drunken men have been known to swallow glass in bravado or for a wager, so some are met with at times who, from the most childish vanity, are not afraid to introduce the most remarkable objects into the urethra.

The same category of cases includes the bodies which the insane push without any reason into all the orifices of the body, though sometimes with an evident suicidal intent. Is it necessary to recall the history of the woman whose adventures Sonnié Moret[1] has transmitted to us, and

[1] Arch. génér de méd., 1835, 2e Série, T. VIII.

who, in order to put an end to her life, introduced the strangest foreign bodies into almost all the natural orifices, into the mouth, pharynx, and rectum. In particular, she had, at the moment of her death, a small parcel of iron wires in the urethra and an open compass in the vagina. One branch of this instrument presented its broken and free extremity in the vagina two inches from the vulva, while the other branch, pressed against the left wall, was imbedded in it to a certain depth. However, persons affected with suicidal monomania very rarely attack the genital organs in order to effect their object; and although the unfortunate referred to above did not die for some days after the introduction of a large number of objects, this termination is none the less exceptional. If death occurs, it is much more frequently the result of extraneous complications than of the accident itself. Nevertheless these unfortunate insane, under the influence of delusions, have not been afraid to introduce metallic tubes full of powder into the urethral canal and to apply a light to it by means of a small match. In a case of this kind, which I observed a few years ago, the explosion had no other effect than to tear the penis and produce hideous mutilation.

Finally, idleness, solitude, and stupidity are reasons which we must invoke to explain this sickly curiosity which leads individuals to plunge foreign bodies into the meatus. While some imprudent children amuse themselves by introducing ears of various cereals into the mouth, others subject the penis and meatus urinarius to strange manipulations. To what shall we attribute the bizarre occupation of the young child who, after having attached a watch-chain to a wire, introduced the latter into the urinary meatus? He had not counted on the aspirating power of the canal, and the wire broke when he attempted, by drawing upon it, to extract from the bladder the foreign body which, having become knotted in the middle, was no longer able to traverse the urethra.

It is very difficult to understand the mechanism of the production of those inexplicable cases of the introduction of foreign bodies into the bladder of very young infants, a year or more of age, unless we admit the wickedness and ignorant stupidity of nurses, who, in more than one respect, resemble the lecherous governesses by whom Rabelais' fictitious hero was surrounded.

This closes the series of causes which induce men and women to introduce foreign bodies into their genito-urinary organs. They are by far the most numerous, and I will merely touch upon the others which refer to foreign bodies introduced accidentally or formed in the organism.

2. Foreign Bodies introduced by "Effraction."—All bodies pushed through the skin belong to this category, and, from the very nature of the traumatism, present a peculiar evolution, which has led me to separate them from the others in order to study them separately in the chapter on foreign bodies by effraction. Their history will therefore be found in the chapters on foreign bodies in gunshot wounds and from simple effraction.

3. Foreign Bodies introduced in Consequence of an Accidental Communication with Adjacent Organs.—Of all the organs surrounding the bladder, there is none whose accidental communication with it is not more frequently the result of the passage of foreign bodies than the intestines. In fact, the functions of the digestive tract, the nature of the substances which it contains, are circumstances which enable us to understand this relative frequency. But it is proper to add that entero-

vesical perforation is not extremely rare in cases of the ingestion of foreign bodies through the mouth. The latter variety of cases has been the subject of special attention in the chapters on foreign bodies of the intestinal tract, and it would not be to the purpose to revert at length to the circumstances attending the production of these accidental perforations. I will confine myself to recalling the fact that they may also be produced by perforation of the ileum and rectum, and that, in a large number of cases of this kind, we are justified in doubting the existence of a perforation of one or the other of these portions of the digestive tube.

The other organs are much more rarely the site of foreign bodies in sane persons, and examples of communication with the bladder are very exceptional. However, objects which have been buried in the vagina, or forgotten there, like pessaries, have been known to perforate the walls of the bladder and even to drop into its interior. In like manner, pins, needles, bullets, and grains of lead of the most varied origin have penetrated into the bladder, after having perforated the urethra or walls of the bladder by a slow ulceration, good examples of which will be found by the reader in the chapter on foreign bodies in gunshot wounds.

Very curious, also, is the history of the organic foreign bodies formed entirely in the economy, and which, after having undergone a temporary or continuous development, pass into the bladder. The ovary has been the most frequent source of this class of affections; and, for the most part, all the organic foreign bodies belong to the category of those observed in dermoid cysts or in cases of extra-uterine pregnancy. These abnormal collections, developed in the vicinity of the bladder, sometimes produce, though always very slowly, an ulcerative perienteritis and empty their fluid or solid contents into the organ. This is the reason that the female bladder has been very frequently found to contain very long hairs of various colors, or teeth which are either isolated or imbedded in an amorphous mass, half osseous, half cartilaginous. At other times the foreign bodies thus produced and found in the bladder belong to a somewhat superior organization, and we find in them the traces of a fœtus developed outside of the uterus. Micturition of hair furnished Rayer with the subject of a very interesting treatise; and though we are at liberty, in some obscure cases, to doubt the internal origin of the hairs, we cannot, with any greater probability, admit, as Cruveilhier does, that some have been introduced by a catheter or spontaneously, in virtue of the power of aspiration which characterizes the urethra. However, such cases are very rare, and it is useless, in a work in which the study of foreign bodies, which have come from without, is alone considered, to devote further attention to this variety of accidental products, which, properly speaking, do not play the part of foreign bodies.

General Etiological Considerations.—From the preceding remarks we may draw some interesting general deductions with regard to the origin of foreign bodies in the male and female urinary passages, according as they are regarded from different points of view. Sex, age, occupation, habits, and diseases, are not indifferent in the production of this variety of accidents. From a comparative study of a large number of cases, Denucé[1] has drawn some very curious conclusions, that are almost verified by the practice of the last twenty years, which I have taken pains to add to his statistics.

1. *Influence of sex.*—Men are more subject to foreign bodies of the

[1] Journ. de Bordeaux, 1856.

genito-urinary organs than women. This is not the place to examine into the moral causes which may explain this difference, but it is evident that the multiplicity of affections of the male genito-urinary organs markedly increases the chances for the penetration of foreign bodies. How often are pieces of catheters, bougies, lithotrites, broken in the urethra and arrested in this canal or in the bladder.

This does not obtain in the female, and I know of only a few cases in which instruments have penetrated and disappeared in the female genito-urinary organs (catheters, pessaries), unless we place faith in the fantastic histories of the victims of their erotic mania, and who often pretend to have had no other object in view but the suppression of annoying pruritus. If the female, endowed with a less imperfect urethral canal than man, appears for this very reason to escape from this variety of pathological causes, we must not forget that, on the contrary, shame and false instincts may lead the unfortunates to attempt criminal manipulations in order to arrest the progress of a pregnancy. These attempts, which are usually made by ignorant persons, sometimes terminate in numerous accidents, and I have found a small number of very interesting cases reported in literature in which foreign bodies of various kinds, being left in the uterus, have become the source of grave symptoms, the history of which is very slightly known.

If we only consider foreign bodies of erotic origin, they are much more frequent in the female, especially if we take into consideration the very early exhaustion of sexual desire in them. In fact, while we find old men employing the most varied instruments in their lewd manipulations upon the urethral canal in order to reawaken the sensibility of the genito-urinary organs, such occurrences have never been observed in old women, and almost all the accidents of this kind have been noticed in young folks, from eighteen to twenty-four years of age. What is the cause of this difference between the two sexes? This is difficult to determine, and we cannot understand why the sexual power in man is prolonged much more than in woman.

2. *Influence of age.*—These considerations naturally lead us to speak of the influence of age upon the production of these accidents. All ages figure in the list of foreign bodies of the urinary passages, from tender infancy to mature life and old age. Side by side with an infant two years old in whose bladder a needle was situated, is found an old man eighty years of age, who has a piece of a catheter or other object pushed into these organs.

Nevertheless, certain ages appear much more favored than others. Examples of foreign bodies in childhood are very rare, and can only be attributed to malicious designs or to a morbid curiosity. In this respect I will mention the case of a child five or six years old, who had introduced, in sport, three small pebbles into the urethral canal. Toward the age of ten years, vicious habits make their appearance, earlier in little girls than in boys, who do not have to employ foreign bodies.

Thus, while the employment of a foreign body by women is a somewhat instinctive manipulation, an exaggeration and false interpretation of a premature need, common to those who masturbate, as well as to those who are not affected with erotic mania, in man, on the contrary, we do not find foreign bodies used except by individuals who, impelled by a bestial frenzy, have at an early period wasted all the natural sexual power at their disposal. At the age of twenty we find many more foreign bodies in females than in males, but we also find them in the latter at the age of

fifty or even seventy years, a period at which desire in the female is, with rare exceptions, long extinct.

3. *Influence of occupation.*—There is nothing more curious than to glance at the various occupations of the masturbators who constitute two-thirds of the cases, as there are interesting relations between the nature of the object employed to produce erection, and the habits of the individuals. These unfortunates, who are not scrupulous, usually employ familiar instruments, and we therefore find, as Denucé has so well shown: an end of a taper used by a nun, a piece of girdle by a Capuchin monk, a needle by a tailor, an etui by a seamstress, a bone of mutton by a shepherd, a piece of a brush by a painter, a branch of a vine by a vinedresser, a pen-holder by a teacher, a pipe-stem by a smoker, a curling-iron by a washerwoman. Hence hair-pins furnish such a large contingent; they are obtainable at any moment, and are suited by their shape for the intended manipulations. It is unnecessary to reiterate how often an indolent life, an absence of the nobler human aspirations, and solitude, favor the development of these unnatural habits. The occupations, also, which do not develop the intelligence, and do not require a display of power proportionate to the age, are especially represented in the long list of genito-urinary foreign bodies. These include, among others, those of shepherd, seamstress, etc., which fulfil the preceding conditions. It would appear that the duties and cares of maternity should exempt the mothers of families from this vice. Nevertheless, several examples are mentioned by various authors, in which mothers had introduced foreign bodies into the urethra. How can we excuse the young woman twenty-one years old and the mother of three children, from whose bladder the physicians removed a piece of wood pointed at one end and with a wire attached to the other, unless we attribute it to mania, and an incomprehensible moral aberration? For it is absurd to believe her statement that it was due to a fall upon a fagot, and that one piece had entered the urethra. Moreover, a woman stated that her husband performed the manipulations peculiar to those who practised the solitary vice.

The mind almost refuses to comprehend to what degree this mania for masturbation may be pushed, and it is only by taking into consideration the authentic examples of the power of this vicious habit, that we can explain the perversion of ideas capable of proceeding even to the most frightful mutilations. Under this category I will report the following illustration which has been copied from Chopart, and is not the only one of the kind. It approaches, in its singularity, the cases of mutilation during coitus for the purpose of intensifying the sensations,[1] and of the case mentioned by Demarquay before the Surgical Society, referring to a confirmed masturbator, who pierced his scrotum with a sharp, cutting instrument in order to rouse and stimulate to his heart's content, the too faint enjoyment.

Observation.— Voluntary mutilation.—Foreign body in the bladder.—Gabriel Galien began to masturbate at the age of fifteen years, to such an excess that he practised it eight times a day. Shortly afterward, the ejaculation of semen became rare, and so difficult, that he tired himself for an hour before obtaining it, which threw him into a condition of general convulsions; finally, only a few drops of blood, but no seminal fluid, escaped. He only used the hand to satisfy his dangerous passion until he had reached the age of twenty-six. Being then unable to produce ejaculation by this means, which only brought the penis into a condition of almost constant priapism, he

[1] Sédillot: Contributions à la chirurgie.

thought of tickling the urethral canal with a small stick of wood about six inches long.

He introduced it to a greater or less distance without covering it with any fatty or mucilaginous substance capable of diminishing the harsh impression which it made upon such a sensitive part. The occupation of shepherd, which he had adopted, afforded him frequent opportunity of being alone and of easily giving himself up to his passion. At different times he employed a few hours each day in tickling the interior of the urethra with his stick. He made constant use of it for a period of sixteen years, and by this means procured more or less abundant ejaculation. The urethral canal, from the so frequently repeated and long continued friction of this kind, became hard, callous, and absolutely insensible. Galien then found his stick as useless as his hand, and considered himself the most unfortunate of men. The insuperable aversion which he had toward women, the abstinence to which he saw himself doomed, and the continual erections which stimulated his passion without relieving it, appeared, in fact, to justify this notion. In this condition of melancholia, which affected both his physical and mental condition, the shepherd often allowed his flock to stray; he continually busied himself in seeking some new means of self-gratification. After numerous fruitless attempts, he returned with renewed fury to the use of the hand and the stick of wood, but finding that these measures only stimulated his desires, he became desperate, and drew a dull knife from his pocket, with which he incised the glans along the urethral canal. This incision, which would have caused the most acute pain in another man, only produced in him an agreeable sensation followed by a complete ejaculation. Enchanted with this new discovery, he resolved to make amends for his enforced abstinence, whenever his fury possessed him. Pits, bushes, and rocks served him as refuges in which to repeat or exercise this new measure, which always procured for him the pleasure and ejaculation which he desired. Having given the utmost possible play to his passion, he finally, after perhaps a thousand trials, divided the penis into two exactly equal parts from the meatus urinarius to that portion of the urethra and corpora cavernosa which is found above the scrotum and near the symphysis pubis. When profuse hemorrhage occurred, he arrested it by tying a piece of string around the penis, and he tightened the ligature sufficiently to stop the flow of blood without interrupting its course through the corpora cavernosa. Three or four hours later he unloosened the ligature and left the parts to themselves. The various incisions which he made upon the penis did not extinguish his desires. The corpora cavernosa, though divided, often caused an erection and diverged to the right and left. Dr. Sernin, surgeon-in-chief at the Hôtel-Dieu of Narbonne, who communicated this case to me, was a witness of the phenomena of this erection.

Being unable to use his knife any farther, because the section of the penis extended to the pubis, Galien found himself in new distress. He resumed the use of another piece of wood shorter than the first; he introduced it into the remainder of the urethral canal, and tickled, at will, this portion of the canal and the orifices of the ejaculatory duct, thus producing an emission of semen. This truly extraordinary masturbator amused himself in this manner for the last ten years of his life, without feeling the slightest uneasiness with regard to the division of his penis. The long-continued practice which he had in the use of this stick rendered him bold and sometimes careless in its use. June 12, 1774, he introduced it so carelessly that it slipped from his fingers and fell into the bladder. Severe symptoms manifested themselves soon afterward; sharp pains in this viscus and in the perineum, difficulty in micturition, fever, passage of bloody urine, hiccough, vomiting, bloody diarrhœa. Tormented by these symptoms, he made attempts to rid himself of his cruel enemy. He introduced the handle of a wooden spoon into the rectum more than a hundred times, and forcibly pushed the spoon from behind forward in order to cause the stick to escape the same way that it had entered; but the condition did not yield to the measures which he adopted. He was finally induced to return to the hospital of Narbonne, in which he had been received three times during a space of two and a half months, and which he always left without experiencing any relief, as he would never consent to an examination in order to determine the cause of his disease. What was the surprise of Dr. Sernin, when, upon examining the hypogastric region of this unfortunate shepherd, who complained of retention of urine, he found two penises, each of which was almost as large as a normal penis. This peculiarity attracted the attention of the surgeon, and although the patient at first assured him that this conformation was congenital, an examination of the parts, of the very apparent cicatrices, and of the callosities along the whole extent of the division, led him to believe that this was not a natural vice of structure. Galien then gave the history of his life, and entered into all the details which we have reported above. Sernin assured himself of the presence of the foreign

body in the bladder, by means of a sound, and decided to perform extraction without delay by the operation of perineal section. The patient, tortured by frightful pains, and not experiencing any relief after taking 100 drops of Sydenham's anodyne solution, submitted to the operation. The incision having been made, the finger was carried to the foreign body in order to change its direction, and one end was turned toward the wound. The stick was extracted with a polypus forceps. As the stick had not remained in the bladder more than three months, the surgeon was astonished to find it incrusted with a large olivary mass of calculous matter at one end. The other end was free from incrustation.

Slight hemorrhage, quiet sleep, the urine escaped without difficulty; on the 5th day a cough, which had tortured the patient for a long time, increased. Fever, irregular chills, relaxation of the bowels, gangrene over the left thigh, buttocks and sacrum. All these symptoms gradually yielded to appropriate treatment. But the thoracic affection continued, and the unfortunate shepherd died three months after recovery from the operation of perineal section.

At the autopsy a considerable collection of greenish pus was found in a sac formed between the pleura and right lung." (Chopart: Mal. des voies urinaires, T. II., p. 114.)

FOREIGN BODIES IN THE MALE GENITO-URINARY ORGANS.

NATURE OF THE FOREIGN BODIES.—In the long series of foreign bodies introduced into the genito-urinary organs of man, the largest number pass through the urethral canal in order to reach the bladder. In order to avoid unnecessary repetitions before entering into the special study of foreign bodies of the urethra and bladder, I have thought it preferable to collect them in one table. For want of a better classification, I have taken the origin and mode of penetration as the basis.

Table of Foreign Bodies Observed in the Male Genito-Urinary Organs.

Foreign bodies of the male genito-urinary organs.

Those originating outside the body.

Introduced through natural channels.

Therapeutic origin.

Catheters, debris of catheters (metallic, india-rubber, gutta-percha), bougies, pieces of lithoclasts, piece of nitrate of silver, cup of a caustic-holder, ivory tip of an English sound, carriage-pin (0.09 m.).

Erotic origin.

Needles.	Shoemaker's awl.	Hair ring with seal.	Bougie, glass tube.
Pins.	Pipe-stem.	Fork, with four prongs.	Awl, wax paper.
Pens.	Heads of grains.	Ear-picks.	Needle-case.
Pen-holders.	Fruit-stones.	Fir branch.	Pieces of polished leather.
Pencils.	Glass balls.	Cotton wick.	Head of garlic.
Pieces of wood.	Metal balls.	Iron wire.	Fish-bones.
Pieces of whalebone.	Pieces of chalk.	Clasps.	Caudal vertebræ of a squirrel, etc.
Soldiers' primers.	Stem of corn-flag.	Alabaster.	
Branch of a vine.	Sticks of sealing-wax.	Cylinder.	
Canula of a syringe.	Matches.	Straw, small key.	
	Hair-pins.		

Various origins. Drunkenness, Insanity.

Pebbles.
Watch-chain.
Copper ring.
Beans.
Peas, etc.
Pins.

Introduced through artificial channels.

Coming from "effraction."

Projectiles, etc.
Wood, etc.
Cloth, etc.

Coming through a communication.

Pins, needles, grains of corn, grape-seeds, fruit-stones (plums, peaches), large wads of charpie.

Formed in the economy.

Teeth.
Hair.
Worms.
Bone, various debris.

On account of the dimensions of the urethral canal, its narrowness and length, we must especially expect to find elongated, not large, foreign

bodies. In fact, this shape predominates in the preceding table. On the one hand are the surgical instruments which present this form, and, on the other hand, the instruments of erotic passion approach these to a greater or less extent.

Shape.—With respect to shape, the foreign bodies are divided into regular and irregular. These two groups occur in almost equal proportions, but they do not by any means undergo the same evolution. The largest proportion of the bodies arrested in the urethra present irregularities which fix them there, while pieces of catheters, which readily obey the forces pulling them in one or the other direction, preserve their mobility and may even terminate very differently from the former. We must classify among these all the pieces of rubber or metallic catheters which are, as a rule, abandoned in the deeper portions of the urethra. Irregular bodies, on the contrary, occupy the anterior portions by preference, and have been introduced in consequence of shameless manipulations. These include pins, needles, clasps, grains, awls, knotted pieces of wood, etc. Certain peculiarities justify us in paying some attention to these various objects; they are usually introduced by the regular or blunt extremity, while the anterior extremity presents irregularities. This is true with regard to pins with heads of glass or other substances, double hair-pins, awls, grains. In reality, they are not irregular unless they travel in one direction, and because the dimensions and shape of the canal are incompatible with their retrograde movement. I have previously had occasion to insist upon this peculiarity of needles, pins, heads of grain, and spikelets.

The external shape does not alone interest the surgeon, as there are physical conditions which explain certain pathological anomalies. Thus, hollow bodies may, as we shall find, be tolerated much better and longer than solid foreign bodies. This is due to the fact that, to a certain extent, they do not prevent the passage of urine, and hence render the symptoms less severe. Nevertheless, this characteristic does not have so much effect as we would believe at first sight, although it is manifested in some cases.

Volume of the Foreign Bodies.—If the reader will bear in mind, after the remarks made in the beginning of this chapter, the ordinary dimensions of the urethral canal, he will understand that the volume of the foreign bodies which enter or emerge from the bladder cannot, in any event, be considerable. It is almost impossible in man to pass beyond the dilatation obtained with Mayor's or Béniqué's largest sounds without causing rupture, and the maximum dilatation is not readily obtained at first, for it is only after a long series of progressive dilatations that the larger sizes, whose diameter is not less than ten to twelve millimetres, can be tolerated. It often, also, becomes necessary to incise the much less extensible meatus, which tolerates the abnormal dilatation less than the other parts. That which the surgeon effects with such difficulty, the masturbator gradually produces by repeated frictions with the most curious bodies. Little by little it appears that all tonicity of the tissues disappears, and the meatus, being enlarged and open, forms with the fossa navicularis a sort of funnel in which such bodies as beans, kidney-beans, a fork four inches long and six lines in diameter, have been poured.

Observation.—Fork in the urethral canal.—Extraction through a wide wound.—"In 1785, a man, twenty-two years of age, introduced into the urethra a fork shaped like those which peasants have in the handle of their knives, four inches nine lines long, and six lines between the prongs. The handle was of horn, pyramidal in shape, and

three lines thick. The body had remained for two days, the penis was tense, inflamed, and trebled in volume. The body could only be removed by an incision in the perineum. The patient urinated two hours afterward. Recovery in six days." (Journal de médecine, 1786.)

The foreign bodies of the individual who introduced a head of garlic and a watch-spring belong to this class.

However this may be, the type of foreign bodies in the male genito-urinary organs is, nevertheless, apart from these exceptions, a long and narrow body, like a pencil, the handle of a brush, a thermometer-tube, a twig of corn-flag or willow, etc.

Some other properties of these bodies merit attention; among others, I will mention the greater or less fragility which they present, or their absolute rigidity. It is important to recognize these peculiarities with reference to treatment and to the final disposition of the foreign body. Thus, a pipe-stem may be broken into a large number of pieces, from the mere efforts made by the patient to withdraw, while manipulation will not have the same effect upon a supple body, like a wick of cotton, a leather shoe-string, or an elastic catheter. It is rare that a brittle foreign body is not broken into several pieces in the urethral canal, and pipe-stem are not the only objects of this class; side by side with them we may place glass tubes, sticks of sealing-wax, certain catheters, etc.

The length exercises a great influence on this brittleness, and a body which is broken because its dimensions will not enable it to assume the curvature of the urethral canal, would remain entire if it were smaller. This consideration of length possesses a real importance, and puts us on the track of certain accidents which could not be otherwise explained. It is not extremely rare to find foreign bodies which are fifteen, twenty or thirty centimetres long, in the genito-urinary organs. The catheters swallowed by the canal belong to this class, but they could not entirely disappear in the bladder if they were not supple, flexible, and capable of bending on themselves. On the contrary, a pen-holder, seventeen centimetres long (Bourdon), a piece of wood, etc., cannot act in the same manner, and if one part is contained in the bladder the other will be unable to enter, but will remain in the canal of the urethra and prostate. Hence, the final result is very different. These few considerations are sufficient to show how the variety of foreign bodies introduced produces pathological consequences. It would cause great prolixity in this part of the work to review all the peculiarities of practice. I will restrict myself to mentioning a few of the most curious ones.

Some foreign bodies present a different structure in the bladder or urethra, especially in the latter, from that which they had previously had. Thus, a wooden pencil formed of two adherent parts has been known to divide into two pieces; another case refers to a small roll of patent leather, which, though introduced while rolled up, was unfolded in the bladder. Upon recognizing the physical properties of the foreign body, we have no difficulty in determining the change of shape which it may undergo. No one would imagine that a stick of nitrate of silver, which was left in the canal, would remain intact; and in a case reported by Dieffenbach, nothing was left of it but a few traces in the midst of an eschar involving the entire mucous membrane.

Apart from the fragments which may result from their accidental division, there are also cases of foreign multiple bodies, either because the individuals, despite the pain and suffering produced by the presence of the first body, have not been cured of their degraded passion, or because

they made unlucky attempts at removal. We have previously mentioned the history of a man who, after the extraction of two pieces of a spring from his bladder, confessed that a head of garlic was also situated in the organ. It is a curious fact that these individuals rarely make a complete avowal of their turpitude, and expose themselves, for this reason, to the danger of the retention of one of these bodies in the bladder. This would have happened to a patient of Bouisson,[1] from whom a piece of wood incrusted with calcareous matter had been removed. The surgeon, after having made the ordinary injections, adopted the wise precaution of examining the bladder with the finger, and, upon describing some movements, it was pricked very forcibly. His attention being aroused, he succeeded in discovering and removing a large brass needle. I am acquainted with five or six analogous cases, which demonstrate that, in certain individuals, passion predominates over suffering, for it persists in them, although their vital energies are worn out by marasmus, and they have arrived at the last stage of urinary cachexia.

But, apart from this source, literature presents a very large number of cases of multiple foreign bodies in the genito-urinary organs.

Sometimes children, without suspecting the gravity of their acts, have introduced small pebbles ; sometimes adults, from an inexplicable aberration, have themselves introduced several bodies. A young man, of whom mention is made in Morand's article,[2] introduced three kidney-beans as a therapeutic agent in enlarging the canal. They passed into the bladder, where they became the nuclei of three calculi as large as pigeons' eggs ; it became necessary to perform perineal section.

Finally, when foreign bodies enter the urinary passages in consequence of a pathological communication with the intestinal tract, it is not rare to find a very large number of alimentary or other substances, usually small, but sometimes very large, such as peach-pits, a nucleated calculus, etc. Velpeau has observed a very curious example of this kind :

Observation.—Migration of a foreign body from the intestine into the bladder.—"A man, æt. thirty years, died in the Pitié Hospital from a considerable stricture of the rectum. Upon opening the cadaver, we found in the pelvis a subperitoneal induration, which almost entirely closed the rectum ; a purulent track extended from this part almost to the liver. A calculus as large as the thumb, and having a pin as a nucleus, was found between the urethra and ascending colon, two inches below the kidney. The pin was situated in such a manner that its head projected into the intestine, while the point was visible in the ureter." (Velpeau: Méd. opér., T. III., p. 236.

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[1] Tribut à la chirurgie, T. II.
[2] Morand : Mém. de l'Académie royale de chirurgie.

FOREIGN BODIES IN THE MALE URETHRA.

CHAPTER I.

GENERAL CONSIDERATIONS.

Whether they pass through or remain in the urethral canal, the foreign bodies give rise to very interesting considerations: physiological in the first instance, and pathological in the second. But, at the moment in which they are introduced, as at the time in which instruments are broken, they are contained entirely within the urethral canal, and it is only after a very peculiar change, which I shall soon investigate, that they fall into the bladder.

The Situation of Foreign Bodies in the Urethral Canal.—All portions of the canal may be the site of the foreign body, and I do not think that we can adopt the opinion of certain authors that there is a place of predilection at one point or another. If we glance through the series of objects which have been left in the urethra, we will find that some are situated in the flexible portion very close to the meatus urinarius ; sometimes, indeed, one portion projects beyond it, and Ségalas has related a case in which the points of hair-pins traversed the glans. Under other and not less curious circumstances, the wire attached to the foreign body introduced into the urethra was suspended outside the meatus. However, the surgeon does not usually observe cases in which the objects are situated so near the external orifice, because the patients themselves have performed extraction, unless, as in the preceding cases, some unusual circumstance renders surgical interference necessary. The arrest of foreign bodies a little lower down is very common, as normal lacunæ are found between the meatus and the root of the penis, and these often retain needles, pins, clasps, etc. The narrower the body is, the less chances it presents of being found very far forward in the male genito-urinary organs, and there are exceedingly few examples of pins and needles which have passed through all parts of the urethral canal. We also find that it is with special reference to the flexible portion of the urethra that a certain number of methods of extraction, to which I apply the titles Suë-Dieffenbach and S. Cooper-Boinet, have been devised. Perhaps the bulbous region is the most frequent site of foreign bodies of the urethra, although, as Voillemier says, authors attribute this preference to the membranous portion, without carefully analyzing the cases. As the foreign bodies always possess a certain length, which more or less deforms the normal arrangement of the canal, I think that it is very difficult to determine this question ; and if we press upon them in the membranous portion (through the rectum), they will project in the peri-

neum ; if, on the contrary, we exercise pressure on the perineum, they will be made to bulge into the rectum. However this may be, both regions are the site of foreign bodies, and, though a number of pins, needles and pencils are arrested at the cul-de-sac of the bulb, the membranous portion has an almost exclusive monopoly of broken ends of catheters, which almost always break at the greater curvature of the canal, either by straightening or by being bent upon themselves. In conclusion, regular bodies are more often met with in the deepest portions of the canal, while large, irregular bodies, which possess a certain amount of elasticity, like double hair-pins, are more liable to be met with in the anterior parts.

A special group may be formed of the bodies which occupy the prostatic region, and which partially project into the urethra. They are not extremely rare, and constitute a curious class of foreign bodies, which participate at the same time in the characteristics of those of the bladder and urethra. Circumstances of a physical nature usually retain them in this abnormal situation ; or perhaps their firmness will not permit them to sufficiently straighten the urethral curve without tearing some part of the canal ; or perhaps their dimensions when they are firm prevent their introduction into the bladder, the neck of which they occupy. Bourdon[1] had briefly called attention to this variety of foreign bodies, and reports a beautiful example observed at Prof. Spilmann's clinic at Val-de-Grâce. On account of their relatively small number, and the similarity of the symptoms with those of foreign bodies of the bladder, which are encrusted with calcareous salts and partially engaged between the neck of the bladder and the prostate, I have not deemed it necessary to enter into a special study, and I refer to the chapter on foreign bodies of the bladder for all information concerning them.

Finally, in a very few strange cases, the entire urethral canal has been occupied by a foreign body which could not be withdrawn. I will not speak of the difficulty which surgeons have experienced in removing bent or worn lithotrites, or those which they could not close, but of apparently inoffensive bodies. I publish the following case, which is copied from Morand :

Observation.—Bougie introduced and knotted in the bladder.—A man, who had grown tired of an obstinate discharge of urine, was advised to introduce a bougie into the penis, and for this purpose a very long one was given him, composed in great part of waxed threads like those which are used in small paper lanterns. The patient, who was as poorly taught with regard to the manner of employing the bougie as of its selection, allowed one end to remain so long in the bladder that, being softened and having been pushed in different directions, it became knotted in the bladder. The young man, after having allowed it to remain there for some time, had great difficulty in removing it, and finally extracted it, although knotted. But this forced extraction was followed by a free hemorrhage, tension in the abdomen, swelling of the penis, inflammation of the testicles, etc. He finally recovered. (Mémoires de l'Académie de chirurgie, T. II., p. 420.)

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[1] Bourdon : Thèse de Paris, 1871.

CHAPTER II.

FIXATION AND MOBILITY OF FOREIGN BODIES OF THE URETHRA.—THEIR PROGRESSION IN THE CANAL.—VARIOUS THEORIES.

Certain circumstances may vary the condition of fixation or mobility of the foreign body in the canal, apart from its shape and regularity, which play the chief rôle. Sometimes the size of the body dilates a portion of the urethra to its maximum and prevents all spontaneous or communicated movements; sometimes irregularities, the points of pins or needles, engage in the mucous membrane, and suppress all mobility. But, in some cases, regular and smooth bodies have been known to lodge in one of the valvules of the flexible portion, and cannot be moved. Finally, the length of the foreign bodies which are situated in the prostatic region, and which project against the wall of the bladder by one end, also favors immobility.

However, fixation very rarely occurs, and despite the erroneous assertions of some authors, we find, upon analyzing the long series of observations in which the foreign bodies have been introduced into the urethral canal, that more than two-thirds, especially of those which are regular, pass into the bladder. The fixation of bodies which have been introduced for a long time may be so great that the body is deeply implanted in its walls. Ségalas had occasion to attend an officer who, as a supposed surgical remedy, had introduced a hair-pin into the urethra. At the time in which the patient presented himself, and in consequence of manipulations made in order to remove it, added to the expulsive action of the canal, the two points had traversed the glans and gave the organ some resemblance to the head of a snail armed with its two horns.[1]

Hutin observed a somewhat different, but very remarkable case of fixation of a foreign body in the flexible portion of the urethra. It referred to an old pensioner, æt. 78 years, who, in order to open some abscesses of the canal, according to his statement, introduced a little stick of wood attached to a wire. When the old man wished to withdraw this singular instrument, he could not extract it because the anterior end projected against the wall, in which it became deeply imbedded. We shall see at a later period, in discussing treatment, to what a series of complications this peculiar accident gave rise.

The rule, therefore, is that foreign bodies of the urethra possess a certain amount of mobility, but this is not absolute, as it is most frequently in only one direction. Experience has long dispelled all doubt on this point, and the shape of the body as well as its manner of penetration, determine the direction of its movement. Hence, it is easy to understand that a stalk of grain or a hair-pin introduced by the blunt and regular end, can only possess a centripetal motion, as the opposite movement is prevented by the engagement of the points in the mucous membrane.

Other bodies are capable of moving in one direction or the other under the influence of the least impression, and they usually respond to the action of the cause first brought into play. In order that the urine should be passed after the introduction of the foreign body, the latter must be expelled. If the canal alone acts, on the contrary, it will gradually pass

[1] Moniteur des hôpitaux, T. IV., p. 104.

the body into the bladder, according to a mechanism which I shall now explain.

The progression of foreign bodies introduced into the urethral canal has been recognized from an early period, but it has only been carefully studied during the present century. Though the phenomenon itself is undoubted, this is not true of the various explanations which have been offered by the different authors who have written on the subject, viz.: Civiale, Ségalas, Mercier, Foucher, Granjux, Philips, Bourdon, etc. It would be idle to enter into the discussion to which the question of the migration of foreign bodies in the urethra has given rise. They take their point of departure in an assertion made by Civiale,[1] which is ingenious, but often contradicted by practice. He had advanced the opinion that foreign bodies introduced into the meatus urinarius advanced toward the bladder, while those which pass from the bladder into the canal progress, like the urine, toward the exterior.

Ségalas soon battered a hole in Civiale's theory, which he regards as an error, basing his statement on a large number of cases which prove that two currents—a centripetal and centrifugal—are present in all parts of the canal, and that the foreign body does not follow one or the other, except in consequence of peculiar circumstances which depend on its physical properties, the condition of the urinary function, the variable degree of congestion of the parts, etc. Finally, he maintained that the manipulations performed by the patient for the purpose of attempting to extract the foreign body almost always resulted in imbedding it still farther. In these statements I see nothing but a simple observation of facts, but no satisfactory explanation, for we cannot admit that the entire aspiratory power which the canal possesses is situated almost exclusively in the membranous portion. Why, according to this hypothesis, are foreign bodies of the penis swallowed by the canal?

Previous to the discussion between Civiale and Ségalas, in 1860, before the Academy, Denucé had expressed some opinions with regard to the mechanism of this progression. It is interesting to obtain the opinion of this celebrated physician, who is so competent in this question. According to him, the centripetal progression of urethral foreign bodies is explained by a general physiological law, from which it follows that all the excretory canals, after the act of emission, performed a sort of retraction, an antiperistaltic movement excited by the last portions of the excreted matter, and which tends to draw them violently toward their reservoirs. I do not think that we can put much faith in this view, because it is based on inexact grounds. The urine and semen never produce, at the moment of their emission, an antiperistaltic movement which forces them into the bladder or vesiculæ seminales.

The final perineal contractions and those of Wilson's muscle have no effect beyond the expulsion of the final portion under the form of a sudden spirt—replaced in the old man, whose muscle is fatigued, by a discharge drop by drop, which continues for a certain length of time independently of the action of the will. The action of the muscles is confined to this during the emission of urine and semen, and, in place of a centripetal movement, there is only a centrifugal one. Demarquay limits himself to the observation that the efforts of the patient greatly favor progression, without attempting to explain the mechanism. Some authors, among others Mercier and Philips, have attributed a preponderating part

[1] Académie de Médecine, 1860.

to the muscular elements of the canal itself. Ségalas had advanced the idea that the muscular fibres of the membranous portion of the urethra and the bulbo-cavernosus muscle might take part in this movement, but he did not insist strongly upon it.

Philips does not believe that the bulbo-cavernosus has any influence whatsoever, and limits its action to the production of erection. I do not share the opinion of this author, and I believe that the muscle does not flatten the bulb in the production of erection.

Mercier has endeavored to explain the manner in which the passage into the bladder is effected, by the interference of the muscular fibres of the neck, which he has especially studied. "I have demonstrated," he says, "that the neck of the bladder is closed by a traction of its posterior surface above the anterior. This being admitted, we will suppose that a sound has penetrated into the canal beyond the meatus, and that this movement of the posterior surface is vigorously performed. It will tend to make it see-saw and glide along the anterior surface, and carry it toward the anterior wall of the bladder. It will then mount with each contraction, and, as it never recedes, it will finally be entirely absorbed."

This ingenious explanation only applies to foreign bodies which have passed through the membranous portion, and it therefore remains insufficient. Foucher,[1] doing justice to all these notions, has shown that erection, the manipulations and shrinking of the penis, favor the action of the longitudinal fibres, and produce progression toward the fixed point. Beyond the pubis it will be grasped by a powerful muscular apparatus. Of all these authors, Granjux[2] appears to me to have better understood the action of the various anatomical elements in the progression of the foreign bodies of the urethra. With Foucher he admits that, at the moment in which erection ceases, the foreign body is drawn toward the pubis, which acts like a fixed point. But, for deeper progression, he believes in the interference of the urethral sphincter and the ribbon-shaped circular fibres of the membranous portion, "a ring which, on account of the number and shape of its fibres, lets go its hold with difficulty." He established an antagonism between the longitudinal fibres which tend to carry the foreign body toward the neck of the bladder, and the circular fibres which tend to push it forward. If the longitudinal fibres predominate, as occurs when they have a solid point of support, centripetal progression will take place. On the contrary, if a portion of the sound remains outside, then the point of support of these fibres is not sufficient, and the irritated circular fibres force the foreign body to execute a retrograde movement. We can also readily conceive that an equilibrium may be established between these two forces, and this occurs when a catheter is in the bladder.

In conclusion, a foreign body must be entirely within the canal, in order that it may progress, because the longitudinal fibres will then find a sufficient point of support at the glandular extremity.

But how does progression occur, if the body is pointed, like a needle, an awl, etc. The action of the longitudinal, added to the resistance of the circular fibres, will result in causing the point to be imbedded in the wall. Nevertheless, these bodies advance. In these cases an active cause is brought into play, viz., the retraction of the penis after erection. If a hair-pin six centimetres long is introduced into the urethral canal, and abandoned at the moment in which ejaculation occurs, the temporarily

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[1] Foucher: Bull. de thér., T. LIX., p. 50.
[2] Thèse de Strasbourg, 1870, p. 10.

elongated portion of the canal, which actually measured six centimetres, will be reduced to three or four, I will suppose, when erection ceases. The foreign body, which is rigid, must, however, occupy six centimetres of the canal. Not being able to escape through the meatus, because the point catches, and also because this part is very narrow, the pin occupies the necessary length in the deeper parts, and therefore a body, which occupied the middle of the penis during erection, is situated at the root of the organ a few moments later. In order to better understand the importance of this mechanism, I think that we should take into consideration the curious antisperistaltic movement which occurs in the penis when the blood retires. The removal of the blood occurs by starts, and the penis returns to the normal condition by a series of oscillations which gradually become weaker and weaker. This movement is very favorable to the progression of the foreign body, which inevitably moves toward the perineum, and never toward the meatus.

Whenever erection occurs, we must expect a movement of progression of the object at the moment that the penis becomes flaccid. This is so true that the mere irritation produced by contact may suffice to explain the progression toward the perineum. In fact, the tractions of the patient, and the irritation after the introduction, produce successive erections. At the moment at which the canal is distended, the portion of the mucous membrane covering the arrested body becomes unfolded and lengthens, and when the erection subsides the body is carried toward the perineum by the mechanism just described. This explains the fact that pins and needles may reach the perineum.

Affairs do not always run this course. There is no doubt that foreign bodies are found imbedded in the wall by their anterior free extremity. This is due to the traction and manipulations rather than to the circular fibres, which are very feeble in the anterior portion of the urethra. Voillemier imperfectly understood the real mechanism of the progression of these foreign bodies, but he attributed to the traction a part which is due to the erections produced by irritation. "The restless patient," he says, "desiring to get rid of the body which distresses him, pulls upon the penis. In this movement, the walls of the canal readily glide upon the pin, the head of which is turned toward the bladder. But, during their retraction they press upon the point of the pin and carry it backward. The mechanism is then the same as that employed by children in order to make a head of barley creep up their clothes." Voillemier did not, however, refer to the elongation of the canal during erection, and in this respect, in my opinion, he gave a wrong explanation.

The influence of erection upon the canal is felt as far as the bulb. Here other causes intervene to facilitate progression. On the one hand, if the foreign body is somewhat long, the action of the spongy portion continues and forces it to pass through the middle aponeurosis. When it is once seized by the muscular region, it is firmly fixed and its progression becomes a very complex phenomenon, the production of which is due in part to movements of the floor of the pelvis, and in part to the action of the neck of the bladder, as Mercier has shown. There will be so many more chances for the production of this passage the shorter or more flexible the foreign body is, because so much force will not then be required to straighten the curvature of the urethra.

It is well established, then, that the bulbous portion of the urethra is a place of temporary arrest for a large number of foreign bodies, and a permanent abiding-place for others, to the study of which I will return at

a later period. The passage into the bladder is usually effected very promptly. In less than twenty-four hours a body left in the meatus has fallen into the bladder. But it is useless to insist upon an enumeration of all the infinite variations which may exist, according to length, shape, and volume, and especially to the part of the canal primarily occupied by the foreign body. Catheters or pieces of catheters, for example, which have broken in the deeper portions of the urethra, will be much more rapidly "swallowed" than a pin which is let go by a masturbator at the moment of the orgasm. The following example shows that the passage into the bladder may not be accomplished until after the lapse of several days.

Observation.—An ear-pick in the urethra.—Its passage into the bladder.—"A hermit who had suffered from difficulty in micturition (?) for some time, introduced an ear-pick into the urethra, which he was unable to remove. After he had felt it in the perineum, for three days, and had suffered severe pain, the foreign body fell into the bladder, where it became the nucleus of a calculus, which necessitated the performance of perineal section."

In a case reported by Terrillon,[1] the foreign body, a pencil, had remained in the middle of the canal for fifteen days before passing into the bladder.

CHAPTER III.

PRIMARY SYMPTOMS AND ACCIDENTS.

THERE is nothing more variable than the symptoms and accidents which occur after the introduction of a foreign body into the urethra. At times they are almost absent, while in other cases they soon assume an exceptional intensity. In the present section I only refer to those symptoms which are commonly observed, and which are all included under the three following groups:

1. Disorders of sensibility, or subjective phenomena.
2. Functional disorders.
3. Inflammatory symptoms.

1. *Disorders of sensibility.*—It is rare that the presence of a foreign body in the urethra does not give rise to intense pain in the region in which it is situated. Although the sensibility of the urethral canal may be somewhat blunted in the individuals who are the victims of this variety of accidents (if they occur in patients who suffer from chronic urinary affections, or develop after lewd manipulations), nevertheless the prolonged contact of a foreign body with the mucous membrane for several hours becomes very distressing. This pain very frequently increases when the foreign body is irregular, as the penis cannot retract completely; and the frequent erections, which are partially due to the tractions made upon it in the vain endeavors at extraction, can only increase the sometimes very severe pains. If the foreign body is pointed, like a pin or a

[1] Bull. Soc. Anat., 1876, p. 651.

needle, the painful sensation is much more acute; and as all movements produce pain, the unfortunates keep the organ as immovable as possible. On the contrary, when the body was primarily situated in the bulbous or membranous portions of the urethra, the pain slightly changes in its character. It is more endurable than in the previous case, but it radiates into the perineum, thighs, hypogastrium, and abdomen. It produces a feeling of heaviness in the perineum and the characteristic distressing dilatation which occurs when calculi are arrested in this portion. In the beginning, pieces of catheter may not produce any pain.

2. *Functional disorders.*—The functional disorders at the onset are all mechanical, and result almost entirely from the obstruction experienced in the emission of urine on account of the presence of the foreign body which constitutes an obstacle to its passage. The obstacle is rarely sufficient to produce complete retention. Moreover, changes in the discharge occur, so that the normal conditions of expulsion are often slightly modified. In fact, the local irritation at the situation of the foreign body is promptly transmitted to the neck of the bladder, and produces an incessant desire to micturate. The patients at first make all possible efforts to expel the object during micturition, and cases have been observed in which this measure succeeded when all others had failed. But, if it is not efficacious, it is useless to endeavor to renew the attempt, because the urine continues to escape drop by drop, the desire being due to irritation of the neck of the bladder. In individuals whose canal is very large, and this is true in the majority of persons, the fluid may even pass between the foreign body and the wall of the canal, in the same manner that it escapes alongside of a catheter introduced *à demeure* in persons suffering from diseases of the urinary passages. At other times, when the foreign body is pierced in the centre, the urine may, for a certain length of time, flow through this channel, thus removing, at least temporarily, all danger of retention.

Velpeau has published a case of this kind, in which a man urinated through the lumen of a pipe-stem which had lodged in the urethra.[1]

Another case refers to a glass tube, which in the beginning permitted the passage of urine:

Observation.—Case of a tubular foreign body.—In May, 1773, a boy, aged 23 years, had a fall while carrying a sack of corn. He micturated blood, then had difficulty in urination, which he thought he could overcome by introducing a barometer-tube, four inches nine and a half lines long, and three and a half lines in diameter, through the urethra into the bladder. He pushed the tube in until he saw the urine flow, but, the object being too short in proportion to the length of the urethral canal, its outer end, far from passing outside of the opening of the glans, was found concealed in the urethra. The young man did not become alarmed, as he thought that, by lying upon the abdomen and allowing the penis to hang down, the peculiar object would be removed by its own weight. He soon found that he was mistaken in his calculation, for, instead of being relieved of the foreign body, it was introduced more and more, so that, the posterior end entering deeper into the bladder, the anterior descended to the root of the penis. In truth, this piece of tube served as a conductor of the urine, and the patient tolerated for three months the annoyances caused by a body which was so long and which possessed such a large calibre. It was extracted by making a long incision. The recovery was complete in nine days. The portion of the cylinder which had been in the bladder and the inner surface of the tube were incrusted, so that the passage would have been interrupted in a very short time.

Catheters also belong to the same category. Nevertheless the functional disorders are not always prevented by the existence of this inter-

[1] Velpeau: Bull. de thérapeutique, T. XXXVI., p. 567.

nal canal, especially when the hollow body does not possess sufficient length. Thus, rings produce rather than prevent retention of urine, because swellings of the mucous membrane form at both ends, which obstruct the orifice, and may even oppose an insurmountable barrier to the free passage of urine.

Observation.—Tip of English sound in the urethra.—In a case which was reported by Andant and Lonstalot, a man had introduced an ivory-tipped English sound, with the latter end foremost. Upon withdrawing it, the tip remained in the canal. He was unable to urinate, as not a drop of urine could escape. The abdomen soon enlarged from the retention.

When the foreign body is very large, the functional disorders are much more marked. Thus, there was complete retention in the man of whom I have previously spoken, who had a fork four inches long in the urethra. It was necessary to catheterize him two hours after extraction, as he was unable to pass any urine.

The qualities of the urine frequently change at an early period. It is not rare to find it becoming sanguinolent, and, whenever the patients force themselves to satisfy their incessant desire, they suffer from intolerable distress and pain. Free hæmaturia is hardly ever observed; when the foreign body has very seriously wounded the mucous membrane, the blood appears to dribble from the meatus urinarius, usually mixed with urine.

3. *Inflammatory symptoms.*—The initial irritation is very frequently followed by inflammatory symptoms of varying intensity, which are usually proportionate to the degree of fixation of the foreign body. It is absent or slightly marked when the bodies are movable, and attains its maximum in cases of implantation, because a slight extravasation of blood and urine very frequently occurs through the wound in the mucous membrane. Urethritis is the slightest of these complications; it is characterized by an acute pain during micturition, and the discharge of a fluid produced by the mucous membrane, at first sero-sanguinolent, and a little later frankly purulent. The inflammatory symptoms vary slightly according to the situation of the foreign body in the flexible or perineal portion of the urethra.

In the first case, the penis soon becomes swollen; it is doubled or trebled in volume, is œdematous, and assumes a red color. All parts participate in this almost phlegmonous inflammatory swelling, the point of departure of which is situated in the urethral canal. The pains are very acute and radiating, and fever develops in almost all cases. The very peculiar characteristics of this fever are, in the beginning, similar to those known as urethral fever. Sometimes it does not appear until the period at which the inflammatory symptoms develop, *i. e.*, on the second or third day. Sometimes, on the contrary (and curious examples of this have been observed), it develops before all the other symptoms during the first twelve hours, has an exceptional intensity, and presents an intermittent type.

On the other hand, when it is accompanied by inflammatory phenomena, when the penis is red, hot, tense and infiltrated, it assumes the continuous type. The surgeon rarely has occasion to see the various phases of this initial inflammatory period follow one another under his own observation. This is readily understood, because the fearful sufferings of the patients oblige them to seek assistance at an early period, and the surgeon prevents the development of the symptoms in question by extracting the body as rapidly as possible.

The symptoms are somewhat different when the foreign body is situated in the deeper portions of the urethral canal. The swelling is then not so apparent as in the preceding case, as it is manifested in the deeper portions of the perineum, which is tense and painful. Fever is also present, and may occur in both varieties. The deeper inflammatory accidents are distinguished by their very rapid spread to all the surrounding organs, and their tendency to propagation along the length of the canal. There is almost always obstinate constipation, symptoms of cystitis, and a painful œdema which extends to the root of the penis. At a little later period, orchitis very frequently develops. But the latter accidents constitute rather the secondary complications, to which I shall again refer.

In conclusion, I will also mention the symptoms of a peculiar character which develop when the foreign body, in addition to the irritation due to its presence, also exercises a caustic action on the mucous membrane. Pieces of nitrate of silver have sometimes been left in the canal, either with or without the cup of the porte-caustique, and in these cases the destruction produced has always been considerable. In support of this statement, I will briefly report the following case:

Observation.—Cup of a porte-caustique in the urethra.—Extraction.—A man, who had had the cup of Lallemand's caustic-holder broken off in the urethra, had attacks of fever exactly like those of intermittent fever during the next two days. The foreign body was extracted with the aid of Hunter's forceps, but a tubular eschar more than a centimetre long was produced at the same time. After removal, a discharge of blood occurred with persistent dysuria. (Gazette des hôpitaux, 1845.)

CHAPTER IV.

CONDITION OF FOREIGN BODIES IN THE URETHRA.

The foreign bodies introduced into the urethral canal may undergo various changes: 1, according as they are expelled spontaneously through the canal; 2, according as they pass into the bladder, on account of their gradual progression toward this organ; 3, finally, they may also remain for a longer or shorter period in the urethral canal, either because the latter tolerates them, or because they are incrusted with calcareous salts which produce severe inflammatory phenomena. I will therefore study in succession, in three special paragraphs:

1. The spontaneous expulsion.
2. The passage into the bladder.
3. The prolonged presence in the urethra.

1. Spontaneous Expulsion of Foreign Bodies of the Urethra.—Spontaneous expulsion is undoubtedly the least frequent of all the terminations of foreign bodies in the urethra. Nevertheless, it is very probable that patients who have had the good fortune to experience such a lucky termination to their own cases would not boast of them; and the very rare cases of expulsion reported in literature have been observed in persons who had already presented symptoms, or as a consequence of the breaking of catheters in the canal.

The occurrence of spontaneous expulsion demands certain indispensable conditions. In the first place, it is necessary that the shape of the body should not oppose its retrograde migration. Thus, a double hairpin, the two points of which fly back and are continually pressed against the walls, has very slight chances of spontaneous expulsion. Regular pieces of a catheter, on the contrary, have a much better chance; and upon looking over the list of foreign bodies which have been expelled spontaneously, we find that these constitute the larger share.

The stream of urine is usually the most efficient factor in producing expulsion. It acts *a tergo* with an intensity which becomes greater the more the bladder is filled with fluid, if the organ has not lost a large portion of its contractile force from the prolonged irritation and the incessant efforts at micturition. But other conditions must intervene in order to further the action of the urine, to relax the muscles of the perineum, to diminish the exaggerated sensibility of the canal, and, if the foreign bodies are irregular, to prevent their impaction against the mucous membrane.

How are these conditions realized? Expulsion has sometimes been effected in a warm bath, aided by pressure upon the perineum. Anderson's case referred to a piece of gutta-percha catheter which had been broken in the urethral canal, and which was spontaneously passed under these conditions, by simple pressure on the perineum, and was extracted by the patient himself. The author does not mention whether the displacement was caused by the action of the stream of urine; but the common effect of a warm bath is to stimulate micturition, and everything leads us to believe that this was not an indifferent matter in the case in question.[1]

Spontaneous expulsion is also greatly aided by slightly compressing the two lips of the meatus urinarius at the moment of micturition. Then, under the influence of the contraction of the bladder, the urine passes between the foreign body and the wall, fills and dilates the anterior portion of the canal, and renders the body movable, which may then advance and present at the meatus. Ségelas observed this form of termination in a case in which the nitrate-of-silver cup of Ducamp's porte-caustique was lost after cauterization. The surgeon directed the patient to make efforts at micturition while he held the lips of the meatus urinarius gently pressed against one another; he had the good fortune to find that the metallic cylinder which caused the distress was immediately expelled.

Expulsion usually occurs at an early period—in the first few days after the introduction; but it sometimes happens that it does not occur until after it has remained in the canal for a long time. Chopart has mentioned an illustration:

Observation.—Incrusted bougie expelled spontaneously at the end of five weeks.—"A man, while straining at micturition, passed a flexible bougie incrusted with calculous matter and folded at one end. Five weeks previously he had forced it into the urethra while endeavoring to relieve an attack of dysuria. This was followed by retention of urine, and catheterism could not be performed since that time." (Chopart: Traité des maladies des voies urinaires, T. II., p. 104.)

2. Passage into the Bladder.—The details into which I entered, while speaking of the migration of foreign bodies in[2] the urethral canal, relieve me from the necessity of entering into minute details with regard to this form of termination. The patient is usually unconscious of it, and

[1] Lancet, 1876, p. 251.

[2] Bull. de l'Acad. de Méd., T. X., p. 826.

does not notice it except from the greater facility with which he urinates, because the symptoms are temporarily relieved or slightly change their character. The patients sometimes notice this movement of progression, and some have been known to go long distances on foot or in a carriage, while compressing the perineum with the finger in order to prevent the foreign body from entering still farther. A very curious example of this kind is reported in Denucé's treatise. The frequency of the passage into the bladder is very great, if we may judge from the hundreds of cases mentioned by authors. Despite the assertions of Denucé, I have been able to convince myself by special investigation that the number of foreign bodies which escape into the bladder is more considerable than that of the objects which remain in the urethra. When once in the bladder they belong to the history of foreign bodies of this viscus, and will be discussed in a special chapter.

3. Prolonged Presence in the Canal.—The surgeon is rarely called to attend patients who have retained foreign bodies in the urethra for a long time. This is readily understood, as the very serious functional disorders which they develop force the patients to seek aid, and the extraction puts an end to their sufferings. However, a small number of cases permit us to sketch the final changes in the foreign bodies which remain in the canal. The duration of their stay is extremely variable, lasting sometimes several days, sometimes several months. A patient, to whom we shall soon refer, had had a mattress-maker's needle in his canal for two years. It is difficult to comprehend how foreign bodies, as irritating and rigid as an object of this kind, can remain for such a long time without producing severe symptoms; but we must also admit a relative tolerance when the patients do not complain.

This is due in part to the fact that the male urethral canal is capable of insensible dilatation. We see to what degree this dilatation may proceed when we recall the dilatations which exist behind somewhat close strictures of the canal. In the case in question an analogous phenomenon occurred, but it did not involve the entire periphery of the canal. On account of the dilatation of one portion, an adventitious pouch formed in which the body was placed and thus permitted the free passage of the urine.

But this phenomenon requires a very long time in its production, as is proven by the calcareous deposits which covered the body—deposits which always constitute a circular and never a partial investment. For a certain length of time the urine then flows between the foreign body and the mucous membrane, then little by little the object forces itself into a cavity which it hollows out and in which situation it may remain for a long time. On account of the accumulation of the deposits it may become irritating, and then produces a series of accidents. The mechanism of the formation of these pouches is well demonstrated by the following observation:

Observation.—Mattress-maker's needle in the urethra for two and a half years.—Incrustation.—"An invalid, æt. 76 years, had a mattress-maker's needle in the urethral canal, which he had introduced on a wager two and a half years previously. The point of the needle caused a projection in the perineum; an incision was made upon it, and, after the point had emerged, a friable and very porous concretion was soon noticed, which surrounded the needle and was adherent to it. This concretion, which had attained the size of a large olive, had formed a pocket in the urethral canal in such a manner as not to interrupt the flow of urine. Recovery in one month." (Société de médecine de Paris, T. VIII.)

All the examples of relative tolerance refer to cases of foreign bodies arrested in the perineal portion of the urethra, and I know of none in the flexible portion. Is not this peculiarity a consequence of the immobility which the former enjoys, compared with the incessant mobility, changes in position, volume, and length of the latter? The fact is that the flexible portion of the urethra is very poorly disposed to tolerate foreign bodies, and that, except at the meatus, the canal does not by any means present the same dimensions as the cul-de-sac of the bulb.

A foreign body may also, by the same mechanism, form a pouch in the prostate or prostatic region. Thanks to this peculiar process, the patient observed by Olivarez retained a needle in the prostate for sixteen years without experiencing any severe functional disorders.

Observation.—Extraction of a large needle which had remained in the prostate for sixteen years.—A man from the Asturias had begun to masturbate at the age of thirteen years, and had soon acquired the habit of exciting the urethral mucous membrane with a very large needle which he held by the point. One day it escaped him and entered the canal; despite the distress and pain, he carefully concealed the cause of his illness, which did not prevent him from attending to his occupation. However, the symptoms became more severe, and sixteen years after the accident he sought relief for his sufferings at a distance from his home. Olivarez of Valladolid, after a careful examination, could discover no trace of the foreign body, and rectal touch was also fruitless. The patient could not be sounded, as a spasmodic contraction was produced simultaneously with the violent pains, and always prevented the entrance of the sound into the membranous portion. The patient referred to the perineum as the site of the pain. He was anæsthetized and placed in the lithotomy position, the lateral incision was made, and the urethra exposed to view over an extent of several centimetres. The needle was not found; the upper part of the incision was then enlarged with a bistoury, and a tumor was opened, which was situated in the region of the prostate; it gave exit to black, thickened blood. At the bottom of this cyst the finger felt the point of the needle, which was extracted with the aid of forceps. The point projected into the canal, and this opening was kept distended by a calcareous shell which surrounded the needle. Normal recovery. (Olivarez of Valladolid: El siglo medico, Oct., 1865.)

The Incrustation of Foreign Bodies of the Urethra.—Whatever may be the explanation, an incrustation of the surface of the body always occurs, as in the preceding case, when the object is tolerated. Every one knows the extreme rapidity with which catheters, which are introduced *à demeure* into the urethral canal, are covered with a peculiar deposit, at first granular, then more consistent and always presenting a very peculiar and disagreeable odor. Authors are almost always silent upon the mechanism of the formation of these incrustations, and restrict themselves to a statement of the fact, which they compare to the white ammoniacal deposits upon objects moistened with urine, in the open air. Is it necessary to show upon what a slight foundation this gross comparison rests? Can we regard two phenomena as parallel, one of which occurs in the open air, while the other is peculiarly confined! I think that in this instance, as in all the glandular canals, a reflex irritation is produced which results in a change in the composition of the urine. This does not occur in the urethra or bladder, but in the kidney itself, the nature of whose secretion changes. I will not revert here to the reasons which have induced me to adopt this explanation; the alteration takes place very rapidly, but it is evident that the urethral canal is not, like the bladder, a very favorable place for the formation of successive deposits, and the latter give rise to accidents long before they have acquired a marked enlargement. Liston[1] saw a calculus which had formed in the urethra

[1] The Edinburgh Med. and Surg. Journ., T. XIX., p. 57.

around a copper ring. Beverwyck [1] cites the case of a child who had introduced a blade of grass into the urethra; a calculus formed at each end of the foreign body.

Observation.—Calculus formed around a needle.—"Gueury removed from the urethra a calculus five centimetres long, the nucleus being a needle around which a calculous concretion of a papillary aspect had formed for a distance of three centimetres. The point of the needle, which was free of all deposit, was directed backward. It was removed by Hunter's forceps at the second attempt; it was situated in the bulbar region." (Recueil de mém. de médecine militaire.)

Fig. 41. Urethral calculus formed around a needle (after Dr. Gueury.)

Observation.—Iron wire in the urethra remaining for a year.—Calcareous incrustation.—On May 20, 1849, Jouault was called to a man who was suffering from retention of urine. Being questioned as to the cause, he confessed that, a year previously, he had introduced an iron wire into the urethra, but that a catheter could be passed. A hard body, about six centimetres long, was found to occupy, upon the median line, the space extending from the anal commissure to the root of the penis. The attempts made with Civiale's forceps failed, and it became necessary to make an incision. For this purpose the foreign body was made to project, and the perineum was slit by a single incision a centimetre and a half long. The extremity of the foreign body then appeared between the lips of the wound and was seized with a pair of forceps, but the most energetic tractions could not dislodge the iron point. The incision was then prolonged and extraction was easily performed. The body was covered with calcareous concretions; catheter introduced *à demeure;* closure of the wound by cicatricial tissue. Toward the eighth day the sound produced slight reaction and was withdrawn. Recovery. (Gaz. des hôpitaux: Sept., 1848, p. 407.)

These cases, to which we might add a small number of others, have enabled an analysis of these concretions to be made, and it is found that they are composed of phosphate of lime, ammonio-magnesian phosphate, carbonate of lime, and urate of ammonia. Since Bourdillat's [2] important work, the chemical composition of urethral calculi has been the object of special study, and this author has found that only half of the concretions contained phosphates. The other half is composed of oxalates, urates of lime and ammonia. The incrustation almost always occurs around metallic bodies.

Inflammatory Symptoms produced by the Presence of Foreign Bodies.—Inflammatory symptoms are always present to a certain extent, although they vary considerably in intensity. The slighter ones consist of an irritation, which is at first acute and then becomes chronic; the urethral mucous membrane inflames and suppurates. Two elements participate in this inflammation: on the one hand, the mucous membrane, properly speaking; and on the other, the glands of the canal, the secretion of which changes, becomes very fetid, and often purulent.

If the presence of the foreign body is persistent, despite the appearance of the primary inflammatory symptoms, which is very rare, these disorders may become much more severe and extensive. The inflammation of the canal is gradually transmitted to the bladder, giving rise to cystitis, at first acute, but soon passing into a chronic condition. On account of the persistence of these symptoms, the general condition changes and emaciation rapidly develops. In some cases, even the kidneys may become the seat of secondary changes, which some regard as the result of the propagation of the vesical inflammation, but which I attribute to the

[1] De Calculo, p. 71.

[2] Bourdillat: Thèse de Paris, 1869.

irritation of reflex origin, which produces the change in the composition of urine. I will only mention this accident, which is very rare, in passing, and I shall again have occasion to refer to it in discussing foreign bodies of the bladder.

The inflammation may also terminate locally in other disorders in the immediate neighborhood of the foreign body. I will only mention *en passant* the possibility of orchitis; the adjacent cellular tissue usually becomes infiltrated; it thickens, hardens, and becomes the point of departure for spots of softening, which are not, at first, in communication with the urethral canal, but which may, at a later period, as the result of a secondary ulceration.

There are much greater chances of the formation of these abscesses if one end of the pointed foreign body has traversed the mucous membranes one or more times, and has introduced into the peri-urethral cellular tissue, which is very liable to become inflamed, a deleterious principle, which results in the formation of an abscess.

Sometimes this abscess occupies the ischio-rectal fossa, as in the following case:

Observation.—Pin in the urethra.—Abscess of the ischio-rectal fossa.—A boy of sixteen introduced a pin into the urethra. He did not complain until eighteen months afterward, at which time an abscess formed in the ischio-rectal fossa, and was opened. The exploration of this cavity with the finger revealed nothing; but, upon introducing the finger into the rectum, the surgeon felt the point of the foreign body through the anterior rectal wall, and was even able to move it. A more careful examination of the perineum led to the discovery of a tumor in the middle of this region. An incision was made upon it, and the needle, incrusted with calcareous matter, was extracted through this opening. Rapid recovery. (Stubbs: Med. Times and Gazette, 1860, V. I., p. 471.)

After these abscesses have formed, they present no tendency to recovery so long as the foreign body remains in the canal, and here, as throughout the entire economy under similar circumstances, they are transformed into perineal or scrotal fistulæ, through which pus escapes, and very frequently a nauseous mixture of pus, urine, and urethral secretion.

I hasten to add that all these accidents are very rarely observed, and this is readily understood, as neither the patient nor the physician allows a foreign body, the extraction of which is far from being beyond the resources of art, to produce grave disturbances which may compromise the urinary function, and sometimes even life, before freeing the canal.

In conclusion, it remains for me to mention the possibility of an accident which is sometimes observed, as the consequence of an injury of the canal by an irregular foreign body which has lacerated the mucous membrane. This is the infiltration of a certain quantity of urine, which, in the mildest cases, terminates in the formation of a gangrenous phlegmon, while, in acute cases, it rapidly assumes the infectious type, and, by gradually spreading, almost always proves fatal.

CHAPTER V.

DIAGNOSIS.

The diagnosis of foreign bodies of the urethra usually presents no difficulties, because the patients put the surgeon on the right track, either by telling the truth, or some more or less fictitious story concerning the nature and origin of the accident. The existence of a foreign body is not doubtful; but this is not true of its exact situation, the nature of the object, the conditions of introduction, and often even of the time which has elapsed since the accident. In surgical cases the matter is very simple, and the piece of catheter, etc., almost always occupies the membranous portion. If this has occurred, we should always make the patient show us the other portion of the broken catheter. This is a source of valuable information, which enables us to determine the length of the fragment, the manner of the fracture, and, in treatment, is serviceable in enabling us to assure ourselves that the entire fragment has been extracted.

In order to determine the nature of the various objects introduced for lewd purposes, the physician must employ great sagacity, apparently giving credence to the patients without attempting to contradict the falsehoods which they invent in order to hide their shame. He must know that the information obtained concerning the manner of entrance (which is very often identical) must be sacrificed in order that he may become informed of the shape of the foreign body, its dimensions, composition, and fragility. It is wise to have a similar object shown, because an exact knowledge may lead to useful indications. This precaution is so much more necessary as the patients are sometimes unable to explain in a comprehensible manner, the exact shape of the cause of their sufferings. In a case of this kind, reported by Herrgott, an individual had introduced a clasp into the urethral canal; despite the simplest questions the man was unable to state the shape of the clasp. The surgeon conceived the happy idea of showing him various kinds, and the patient then relieved him from his embarrassment by pointing out the one which he had used.

Palpation, rectal touch, and exploration of the canal by means of catheterism, are the measures which are usually sufficient to determine the presence, situation, and, up to a certain point, the properties of the foreign body. On account of the very superficial position of the first two portions of the canal, palpation furnishes useful diagnostic data. But it would be inexact not to mention its much superior efficacy in the flexible portion, because the urethra is here under the skin, and, upon passing the finger from the root of the penis to the glans, a very distinct sensation of the foreign body, when present, will be produced. A little lower down it begins to be obscure, especially if the perineum, which is tense and swollen from the presence of the foreign body for a certain length of time, or naturally so from the existence of an exceptionally well-developed adipose layer (Dieffenbach), will not allow ready compression. It is unnecessary to add that we should only perform this manipulation with the greatest caution, for fear of rendering an arrested foreign body movable or of forcing it into the walls of the canal, if it presents any sharp points.

If palpation gives negative results, there is reason to think that the

body is situated in the membranous portion, and, in order to render this certain, we must practise the rectal touch. It is rare that this method of exploration does not furnish very useful indications, especially if we combine palpation of the perineum with it, because one of the fingers may cause one end of the object to project on account of the pressure so that the other finger can detect it more readily.

Finally, if any doubt remains, as happens when the foreign body is small and very short, like a pin or needle, we must explore the canal by means of catheterism. For this purpose we employ metallic catheters of moderate calibre, which transmit sensations very exactly. But the greatest caution must always be employed; and we should never lose sight of one important precept, viz., that the exploration of the canal should not be made unless one finger is kept in the rectum in order to superintend the movements of the foreign body, and especially to prevent it from falling into the bladder when pushed by the catheter. And this precaution is not purely theoretical, as surgeons have allowed foreign bodies to enter the bladder from a momentary forgetfulness of this maxim.

Observation.—Hair-pin pushed into the bladder.—Extraction with the aid of a lithotrite.—A man had a hair-pin in the urethral canal. It was at first situated near the meatus, but then passed into the perineum. Thompson being called upon, decided to perform the button-hole operation. He introduced a sound into the canal, and then found that he had pushed the foreign body into the bladder. He was able to remove it with a lithotrite; after having seized one end and pulling upon it, the pin straightened, and extraction presented no further difficulties. Recovery. (Thompson: The Lancet, Nov. 1863.)

This illustration shows how the simple omission of an apparently trivial precaution may be followed by grave consequences. For, as we shall see later on, the presence of a hair-pin in the bladder is one of the most serious accidents of this kind, and the reader, by following the pin in its movements of unwarping, as in the preceding case, can form an idea of the dangers and grave uncertainties to which such a manipulation may give rise in the bladder and urethral canal. Hitherto, I have presupposed that the patient had confessed the introduction. But there are some who complain of intense dysuria without revealing its cause. We must then employ considerable judgment, endeavor to study the patient, make very careful explorations, and finally, avoid accidents and induce the patient to make a confession.

CHAPTER VI.

PROGNOSIS.

The presence of foreign bodies in the urethral canal is a serious accident, but does not often compromise life. However, there is a great difference according to the individual case. The prognosis is less favorable when the body passes into the bladder, for, after being lodged in the interior of the pelvis, it comes in much closer contact with important organs, such as the peritoneum. The gravity of the prognosis also varies greatly according to the nature of the body. Thus, there are some which,

on account of their shape, cannot be removed from the urethral canal, because they are in contact with and lacerate the walls.

Others, on the contrary, such as pieces of catheters, and in general all regular bodies, are readily extracted through this channel. But the necessity of a bloody operation, even when it bears the mild title of "button-hole," does not give the patient the same chances that are presented after simple extraction. We may even state that, all other things being equal, the bodies which are situated nearer to the meatus produce less serious accidents than those arrested in the perineum.

CHAPTER VII.

TREATMENT.

This chapter, the most interesting of all, comprises a large number of peculiar minor measures, the mere enumeration of which would demand space out of proportion with the size of this work. In order to be complete, I have thought that it would be useful to group together all those belonging to the same method, and which differ from one another by only a few modifications rendered necessary by the individual cases.

Prophylactic Treatment.—I can only discuss prophylactic treatment with regard to foreign bodies of surgical origin, and, in this category, desire progress in the manufacture of catheters, bougies, etc., which constitute the largest proportion of this group of bodies. It is evident that the establishment of some control over their manufacture, as demanded by Meslier, Cloquet, and H. Larrey, is an idea that is only justified in intent, for, as a member of the Academy remarked, we cannot really appoint inspectors of catheters. All that can be done in this respect is to call the attention of physicians to the necessary precautions which must be adopted in catheterism, or, in cases of the continued use of catheters, to teach the patients the manner of introducing them, and the annoyances which may result from the use of old instruments, etc.

Palliative Treatment.—The accidents produced by the presence of foreign bodies in the urethra are of such a nature that curative treatment will alone act as an efficient remedy, and I would have passed over in silence the means employed to produce relief of the functional disorders, if they were not mentioned by a few authors. Of all these disorders, the retention of urine is the one which claims the most urgent interference. It may happen that the surgeon, being called to a patient, has not the instruments necessary for extraction at hand, and that he can only, in the meanwhile, procure some relief by emptying the bladder. It is for this reason that authors advise the passage of a small catheter between the foreign body and the canal, in order to reach the bladder. This little operation is very useful, but only under the condition that the finger of an assistant, introduced into the rectum, presses upon the canal or the neck of the bladder, and prevents the body from falling into the bladder—an accident which is always grave, whatever may be the opinion of some with regard to it.

If we wish to overcome the spasm of the canal, we may, for awhile,

leave a filiform bougie in the first portion, or, by a prolonged bath, obtain a sedative effect which will occupy the patient's attention and favorably predispose the urethra to the manipulations necessary for extraction.

Curative Treatment.—It is evident that the expectant plan is extremely irrational when it refers to an urethral foreign body, and that procrastination offers more annoyances than advantages. There is no doubt that, in some cases, interference is dangerous when, for example, the parts are already the seat of a phlegmonous inflammation, as is seen in the penis.

However, extraction is much more preferable, even in these conditions, because it prevents the propagation of the accidents to adjacent parts and may avert grave disorders. We must, therefore, always remove foreign bodies of the urethra, and all authors are in accord on this question. But this is not true of the course to be pursued in order to attain this end, and the surgeon has usually no other guide to lead him than his own inventive ingenuity, which may finally enable him to free the patient of the troublesome body.

Three great methods comprise all the peculiar minor measures :

First method, comprising all measures whose object it is to favor spontaneous expulsion.

Second method, comprising all measures by which the foreign body is removed through the urinary meatus.

Third method, comprising all those which create for the foreign body an artificial path through the integument.

First Method.—Measures whose Object it is to favor Spontaneous Expulsion.—The first method is the least certain, but it includes a certain number of minor manipulations which are harmless in themselves and whose application is very easy.

I. It has been customary to advise persons who have a foreign body in the canal to retain their urine as long as they can, and to expel the stream with force, in such a manner as to act upon the obstacle as strongly as possible, and thus to drive it away. Unfortunately, the urine soon diminishes in quantity, as I have shown, and it is necessary to obviate this by making the patients take mucilaginous drinks, such as ptisans of flaxseed, in very large quantities. I hasten to state that this slight measure is usually incapable of giving good results unless the body is regular, and unless nothing in its shape or in the condition of the canal opposes its migration.

II. Chopart reports that, at a very early period, suction of the glans was very often employed to favor expulsion. This little manipulation, which is derived from the Arabs, has entirely fallen into disuse, and, apart from considerations of professional dignity, its uselessness exempts me from speaking of it except as a matter of history.

III. This does not hold good of injections, which number some successes and some partisans. Their object is to lubricate the walls of the canal, to isolate the foreign body from the mucous membrane by the temporary interposition of a layer of fluid, which, by rendering it movable, favors its expulsion by the contraction of the bladder. This plan gave a good result in Vigan's[1] case, and he saw the foreign body, which had produced very grave disturbances, gradually travel down the canal and arrive at the meatus in ten or fifteen minutes.

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[1] London Medical Gazette, 1840.

IV. In order to obtain the entire effect possible from injections, it would be advantageous to employ a slight precaution, which consists in pressing the meatus against the extremity of the canula in such a manner as to prevent the reflux of fluid. It is not even necessary that the fluid should be injected, and we can readily employ the same manipulation during the expulsion of urine. Being pressed onward by the bladder and not finding a ready exit, the fluid dilates the urethra to the greatest extent possible, and the foreign body, being isolated, may be expelled at the moment in which the lips of the meatus are relaxed. This little measure was very successful in the hands of Amussat, Sr. He was fortunate enough to remove a metallic catheter which had broken in a stricture, by ordering the patient to urinate while he held the urethra closed with the fingers. When the distention was very great, he removed his hand and the flow of urine was sufficiently strong to expel the foreign body.[1] The same manipulation also succeeds very well with water, oil, and, in general, all fluids. But I do not think that we can employ, advantageously and without danger, the injections of air recommended by Trousset. Nothing is less demonstrated than the harmlessness of the introduction of air into the genito-urinary organs, and, in all cases, fluids isolate the foreign body more effectually from the mucous membrane. In conclusion, this method, which may be called the mild plan, is readily put into practice, and, for want of a better, we may resort to these procedures.

Second Method.—Extraction of Foreign Bodies through the Natural Channels.—Extraction through the meatus urinarius may be effected by means of a very large number of methods, which may all be included in the three following categories:

1. External manipulations.
2. Prehension by means of various instruments.
3. Extraction after special manipulations which modify the size of the foreign body, etc.

1. *Extraction by means of external manipulations.*—It is possible to extract foreign bodies from the urethral canal by the aid of simple external manipulations, whose object it is to act indirectly upon it through the skin and the tissues of the perineum or penis. Two methods have been employed for this purpose, according to the individual case. In one of them, which is most frequently employed and has been followed by the largest number of successes, the pressure exercised from behind forward tends to bring the foreign body nearer to the meatus. In the other case, on the contrary, the surgeon endeavors to compress the penis and the urethral canal in such a manner as to approach the body. The first method is performed in the following manner: I will suppose that the foreign body has already advanced into the membranous portion; the surgeon then introduces the right index finger into the anus, and presses through the tissues upon the posterior part of the object in order to make it advance. When it has reached the perineum, the finger is withdrawn from the rectum and the same pressure is continued; this becomes much more effective as we approach the flexible portion. When the body has arrived at the meatus, the extraction is effected by the aid of forceps or the fingers. This method presents much greater chances of success if the object is situated in the flexible portion. In addition, it is hardly applicable except when the anterior extremity of the foreign bodies is soft,

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[1] Gaz. méd., 1863.

quite large, and has no tendency to be buried in the urethral walls. This includes pieces of catheter, bougies, various instruments, pen-holders, etc. The method must never be employed for pins, needles, double hair-pins, etc.

Morel Lavallée has proposed driving back the penis and urethra, in order to come in closer contact with the foreign body when it is not situated beyond the spongy portion. He was able in this manner, and by taking care to fix the foreign body posteriorly so that it could not escape, to approach very close to a piece of catheter until he became able to extract it. This manipulation should only be employed in very exceptional cases. It is only applicable to a small number of bodies, is poorly regulated, dangerous, and inferior to many other means of treatment.

2. *Prehension by means of various instruments.*—A large number of instruments and measures devised to remove foreign bodies from the urethra belong to this category, but many of them act in the same manner. I will begin with the best ones in common use.

Extraction with forceps.—I will pass the old armamentarium by in silence. The most ancient is Halles' forceps, modified by Hunter, and known especially under the name of the latter surgeon (Fig. 42). It was composed at first of a long, straight canula, and of a wire terminating in two blades, with a spring in the shape of a duck's beak. The wire with springs, when introduced into the canula, constitutes a prehensile instrument, the pressure of which can be modified at will by withdrawing it more or less. Upon pushing it into the canula, the two springs tend to approach one another, and to seize the object. This primitive forceps has been advantageously modified since the last century. Thus, on account of its straightness, it was only applicable to the first part of the canal. Desault, by curving it, converted it into an instrument which is useful in all cases. Furthermore, one piece has been added; this consists of a central stylet, which enables us to determine whether the foreign body is engaged in the forceps or not. In order to make this slight improvement, it became necessary to transform the old central wire into a canula terminating in two springs. A thumb-screw enables us to fix, at will, the second internal tube. Finally, the inner canula has been graduated in such a manner as to determine the separation of the blades, and these have been modified in various ways, their number even being increased.

Fig. 42.—Modified Halles' forceps.

In order to manipulate this instrument, it is introduced closed into the urethra until it comes in contact with the foreign body, which is fixed by an assistant, in the perineum or rectum. The forceps is then gently opened by pulling up the sheath to an extent depending upon the foreign body to be extracted. The open blades are then pushed gently onward by impressing upon the instrument a rotatory movement in various directions. If we use the forceps with stylet, we can satisfy ourselves that the body is grasped. Whatever the instrument employed may be, the surgeon closes the forceps by pushing the external canula, which is fixed according to necessity, and, by gently pulling in various directions, withdraws the instrument and the body which it grasps. Desault's forceps is manipulated in the same manner.

Amussat's spring-forceps is only a modification of Hunter's forceps. A metallic wire, ending in a button, glides in a canula terminating at the anterior end in four tongues. Upon withdrawing the button, the four

tongues separate; on withdrawing it a little farther it falls into an opening, and then the spring-tongues tend to approach one another. The manipulation is too simple to render a description necessary.

Observation.—"A shepherd masturbated by introducing into the urethral canal a small stick, which he moved about until the act was accomplished. The last time that he had performed this manipulation he was drunk, and was overcome by sleep before he had completed the act. The piece of wood was deeply buried in the canal, the largest part being in the bladder. This foreign body, although left in the parts for three days, produced no marked disturbance. Worbe removed it by means of a form of Hunter's forceps. The object was a piece of green vine, fifteen inches long, and the size of a pen-holder at the largest end." (Journ. gén. de méd., T. LXXXIV., p. 135.)

This class of instruments, which were formerly very much employed, has been replaced by very ingenious urethral forceps devised by contemporary inventors. The American forceps, with very long blades, have met with some success, but they are inferior to those of Charrière and Mathieu.

Urethral forceps.—It is composed of a fixed blade, and of a movable one which is articulated with the first by means of two interrupted levers, as shown in Fig. 43. Without entering into details in regard to this forceps, which has very simple and ingenious rings, and is in general use at the present time for all long and narrow canals, I will only state that it has the advantage over Hunter's forceps of being manipulated with one hand, thus enabling the surgeon to operate without an assistant. In addition, as the instrument undergoes no separation, the canal is not torn during the operation.

These forceps are straight or curved, with or without a point of arrest, etc. Being introduced in the urethra, oiled and closed after the manner of a sound, they are then opened and gently pushed forward in order to seize the foreign body.

Experience has shown that it is very difficult to retain foreign bodies by grasping the anterior extremity. In order to succeed, it is necessary that the long blades of the forceps, when introduced closed or opened between the foreign body and the canal, should seize it at some distance. The fixed instrument is withdrawn by performing traction in the proper direction.

With the aid of these forceps, we can withdraw regular bodies whose retrograde movement is not hindered by irregularities, such as hair-pins, pins, heads of grain. We should not even attempt to employ these instruments for the latter bodies, because we run the risk of wounding the canal without attaining the desired object. In order to extract pins, Reliquet has devised a revolving forceps, which applies the foreign body against the instrument, and thus renders extraction harmless.

Collin's forceps (1879) (Fig. 44.)—The urethral forceps which has been recently devised by Collin differs markedly from those hitherto constructed. It is composed of a hollow wire mounted on a handle and terminating in a fixed socket. Another movable socket is put in motion by the pressure of the thumb upon a part situated near the handle. The transmission of the motion occurs by means of an ingenious system of levers. These two parts are very readily separated, and are easily cleansed. This very ingenious and easily manipulated forceps possesses great simplicity.

In truth, a large number of other instruments may be employed as forceps, and are useful in some special cases. These include the urethral

stone-crushers, which in some cases enable us to remove pebbles. I will soon have occasion to revert to this class of instruments. A German author has recently extolled the use of the American worm-screw forceps.[1]

Prehension by various methods.—All the following plans, whose object it is to grasp the foreign bodies, are minor manipulations which it is

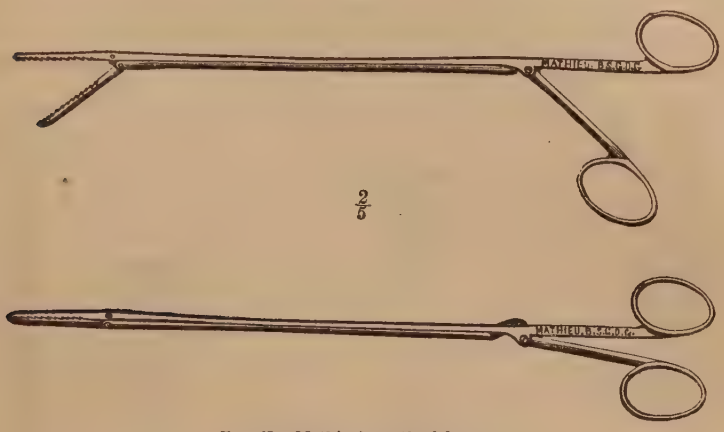

FIG. 43.—Mathieu's urethral forceps.

useful to know, and which prove serviceable when we have no suitable instruments at hand, and when the foreign bodies are irregular, pointed, and dangerous.

Some of these measures resemble one another, and have for their common object the seizure of the foreign body by enclosing it in another by embedding it. The plan adopted by Viguerie is one of the most curious of this kind.

Observation.—Extraction of an urethral catheter by an ingenious method.—A catheter was broken in a man's urethra. Viguerie conceived the idea of cutting a catheter of equal calibre in the vertical direction, and of pushing it forward until it encountered the abandoned portion. When the two parts were in contact with one another, he introduced a square mandrel, which, penetrating the end of the sound, enabled him to withdraw it very readily.

Observation.—An octogenarian broke a silver catheter at a distance of seven inches from the meatus. Young employed a catheter of a larger size, engaged it to the distance of an inch around the broken catheter, and, by causing it to make an angle with the catheter which had remained in the urethra, he was able to withdraw it.

These are not the only examples of this kind, and the plan has proved successful for other objects, rubber catheters, etc. Care must be taken to aid the engagement of the foreign body in the other by pressing upon the former from behind forward. Andant and Lustalot have employed the reverse manipulation to remove the tip of an English sound, which was arrested in the spongy portion. These surgeons, not having the proper instruments for extraction at their command, devised a metallic wire armed with a furrow of a screw, which they introduced into the urethra and screwed into the bony tip of the catheter. They had the

[1] Arch. f. klin. Chir., 1868, T. IX., p. 936.

pleasure of seeing their ingenious device crowned with success, and withdrew the catheter-tip and the wire at the same time.[1]

Ferrier, being called to a patient fifty-five years of age, in whose urethra a silver catheter had broken, made a peculiar turrel, and placed it in a large metallic catheter cut transversely. The instrument, being introduced, came in contact with the fragment of the catheter. Ferrier then caused the turrel to undergo cork-screw movements, and was thus enabled to remove the foreign body. Others have employed a hook, which, being concealed in a canula, was introduced into the cavity of the broken fragment.

FIG. 44.—Collin's urethral forceps.

FIG. 45.—Hooked sound for foreign bodies.

FIG. 46.—Reliquet's urethral lithotrite.

Finally, Voillemier, in a case in which a metallic catheter had broken in the canal, succeeded in introducing into its interior a small catgut bougie, which, upon swelling, afforded a sufficient hold to enable it to be readily withdrawn.

A few minor measures have been employed for pointed foreign bodies. One of these proved successful in the hands of Raynaud de Montauban, but it is not by any means a well-regulated measure. This surgeon, who had to remove a pin from the urethra, introduced a metallic catheter as far as the pin, while the finger in the rectum pressed upon the neck of

[1] Bull. de thérapeutique, T. LXXXV., 1873.

the bladder in order to push the foreign body from behind forward. The pin followed the catheter in its retrograde movement.

The plan adopted by Caudemont is preferable. When a pin is lost in the urethra, we must first endeavor to disengage its point. Pressure is made upon the posterior part with the fingers of one hand, while the other introduces into the canal a large rubber catheter, into the end of which the point of the pin is driven. It is then withdrawn.

This is merely a modification of another method which is much older, and which consists in the attempt to force the point of the pin or needle into a waxen bougie, or into a small ball of wax placed at the end of a hollow sound. Suë succeeded in removing a pin with the aid of a crochet-needle armed with wax at one end.

If the foreign body presents irregularities which render its extraction impossible, as happens with double hair-pins, we may, with advantage, make use of hollow instruments, into which the points are introduced, and thus prevent injury to the canal during the operation. This plan is applicable to simple pins, but it is especially of undeniable utility in cases of double pins and in heads of grain. Avery, quoted by Holmes[1], appears to me to be the first who put this plan into practice. It consists in the introduction of an open canula as far as the pin, the points of which, being brought closer to one another by pressure, are introduced into the open end of the catheter, in which they are retained by their own elasticity; the pin and tube are then readily withdrawn.

Marchettis' manipulation differs somewhat when the object is a spike or spikelet of grain. If the foreign body still projects externally, a wire must be attached to the end and then passed into a large canula, which is pushed into the urethra between the foreign body and the canal. After this isolation has been effected, extraction is very readily performed by pulling upon the wire. If the spike no longer projects outside, matters do not run so smoothly, and we must then proceed with a great deal of caution, and make preliminary injections of oil in order to agglutinate the beard of the spike and to facilitate extraction, which is done by means of a simple Hunter's forceps or Jobert de Lamballe's tube-curette. If the foreign body is composed of multiple parts, we may search for it by pressing upon the posterior portion in order to avoid division. If we do not succeed in this manner, the fragments must be removed separately. This was done by Demarquay in a case of a metallic pen-holder.

Hooks.—Metallic hooks or handles have been employed from the earliest times to remove foreign bodies from the urethra. Martini's handle is undoubtedly one of the most ancient, and is composed of a wire bearing an elongated ring. Being introduced into the canal until it meets the foreign body, it is conducted beyond the anterior extremity of the latter and pushed behind the foreign body; an attempt is then made to pass the body into the ring. This instrument is only applicable to a small number of cases, such as peas, beans, small gravel, pins, etc. We may also employ a blunt hook with a simpler handle of flexible and malleable iron wire, composed of two branches twisted together, except at the lower end at which they form an elongated ring. The surgeon should not rely too much on these measures, as they are far inferior to the previous ones.

We must also include in this category the jointed curette of Leroy d'Etiolles, which has a very restricted application to cases in which the

[1] Principles of Surgery, 1861.

foreign body is small and round, like a bean or small pebble. The instrument being introduced straight, as if for urethral calculi, is transformed into a curette when it has passed beyond the object, and is drawn in this position. Nélaton has advantageously modified this instrument, and has rendered it useful for foreign bodies.

3. *Extraction after special manipulations.—Version.—Fragmentation.*—When extraction by simple means fails, and before resorting to extraction through artificial channels, we should employ various ingenious methods which, though not applicable to all cases, may be usefully combined or modified. Thus, by dividing a foreign body situated in the urethra, we can very markedly facilitate spontaneous expulsion or extraction. For bodies which are not very hard, like concretions coming from the intestines, beans, peas, etc., we can employ the ordinary urethral

Fig. 47.—Curved catheter for urethral foreign bodies.

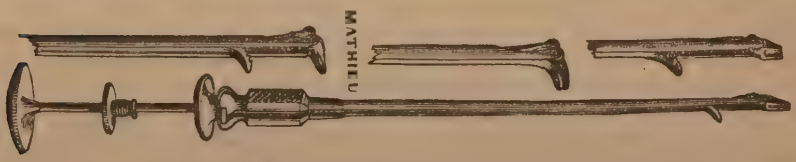

Fig. 48.—Nélaton's instrument for foreign bodies of the urethra.

stone-crushers, which may be followed up by the use of injections. But fragmentation has also been applied to other foreign bodies, such as pieces of wood, as in Voillemier's classical case:

Observation.—Extraction of a twig of a chestnut tree by fragmentation.—"I was called, he says, to a patient who had introduced into the urethra a twig of a chestnut tree, the size of a large sound. He had removed the bark in order that the oily fluid which covers the sap-wood should render the introduction easier. But he had done this so awkwardly that he had cut the wood with his knife and raised small lamellæ, the free portions of which, being directed forward, entered the tissues at each attempt which he made to remove the foreign body. The penis was swollen, red, and very painful, and he could only urinate with the greatest difficulty. Marchettis' method could not, by any possibility, be employed in this case. I then devised another plan, which proved successful. After having cut the twig at about one centimetre from the meatus urinarius, I slit it open in several parts and traversed it throughout its entire length with a probe-pointed stylet, in such a manner as to transform it into a bundle of matches. With the aid of forceps I first removed the central portions, and then all the others in succession. The operation lasted nearly three-quarters of an hour, and the patient was then relieved." (Voillemier: Traité pratique des maladies des voies urinaires, p. 531.)

Version measures.—Samuel Cooper.—Boinet.—Thanks to a very ingenious manipulation, certain foreign bodies, which could not be withdrawn except by the "boutonnière" operation, may be removed through the natural channels. This plan is especially applicable to hair-pins; but, in a general way, it may be used for all pointed bodies. The invention of the plan of version belongs to S. Cooper, but Boinet was the first who put it in practice and popularized it. This surgeon employed it for the first time in order to extract a needle six centimetres long, which was

situated in the spongy portion of the urethra, and the extraction of which presented great difficulties because the point was embedded in the mucous membrane. Boinet firmly fixed the head of the pin with the thumb of the left hand, then bending the penis at a part corresponding to the point, he made the latter project through the walls of the urethra, and drew it out with the exception of the head, which, being too large to pass through the opening made by the pin, remained in the canal in the situation occupied by the point a few moments previously. He had thus withdrawn the body for a distance equal to its own length. This being done, by a see-saw movement from above downward, he lowered the point of the needle toward the root of the penis in order to make it enter the canal by pushing it from below upward, and in such a manner that the head protruded first from the meatus urinarius. It was then easy to perform extraction of the foreign body, which was not more than a few millimetres from the urethral opening, by seizing it with a pair of dissecting forceps.[1]

Since then this plan has furnished other good results. Launay, of Havre, was thus enabled to extract a hair-pin from a sailor's urethra. Instead of making the foreign body glide from behind forward by pressure, as Voillemier advises, we can with advantage make use of Hunter's forceps, or of an urethral forceps, which will seize the head so much the better, because the other extremity of the foreign body is then in the hands of the surgeon.

However, we should not exaggerate beyond measure the advantages of this ingenious idea. Gosselin, after having tried version in one case, was unable to withdraw the foreign body, and was compelled to perform the "button-hole" operation.

Version is not alone employed for single, but also for double pins. We then perforate the skin with the two points and turn back the bend when the entire body has been drawn outside. Extraction of the curved portion is then easily performed by means of a pair of forceps or a hook.

Unforeseen circumstances sometimes force the surgeon to devise measures which have no precedent, but which must face all the peculiarities with which he is brought into contact. In the following case it became necessary to cut the mucous membrane of the canal through the meatus in order to extract the body, although a wire to which it was attached hung from the meatus.

Fig. 49.—Jointed sound for foreign bodies of the urethra.

Observation by Hutin.—Piece of wood in the canal.—Peculiar manipulations in extraction.—"An old invalid, æt. 78 years, was accustomed, he said, to open his urethral abscesses by means of a stick of white wood which he introduced into the canal after having fastened it to a wire. He used it like a bodkin. At the third attempt he was unable to remove it; the wire remained outside and was attached close to the end

[1] Gaz. méd., 1861, p. 284.

which had been first introduced into the urethra. By pulling upon it the patient had engaged the other end in the mucous membrane. Hunter's forceps removed nothing but clots of blood and debris of the mucous membrane. Hutin introduced a small dressing forceps, steadied the stick of wood through the mucous membrane, and then, with the aid of a pointed bistoury which was slipped along the forceps, he made an incision upon the upper end of the foreign body, which he caused to project through this counter-opening and withdrew as far as the meatus, where it was extracted. It became necessary to make the wire follow the same course as if it had been a seton-thread. A catheter was introduced *à demeure*. On the following day the penis was swollen, and the scrotum red and very inflamed. Temporary improvement; then fever developed, the parts became infiltrated, and death occurred on the eighth day from prostration.

At the autopsy, a large abscess was found which was filled with a greenish brown matter having a putrid odor. It was very deep on the left side, where it presented a communication with the rectum.

This instructive example shows both the embarrassment of the surgeon in cases which are apparently very simple, and the dangers which result from a wound of the urethral mucous membrane. We must also mention as an exceptional measure the one employed by Desault in a case in which a pin six centimetres long was forced into the canal. This surgeon pressed one finger firmly upon the lower part of the urethra where the point was situated, and fixed it in this position. The forceps were again introduced, and pushed sufficiently forward to seize the foreign body an inch from the point. By pulling upon the pin, the latter curved in the form of a hook, and, by pulling upon this, extraction was effected through the meatus. This plan should not be imitated unless the foreign body is very flexible.

Of late years it has been proposed to extract certain foreign bodies, which are grasped with difficulty, with lithotrites or special instruments, after having pushed them into the bladder.

Reliquet advised and practised this peculiar manipulation. It is very difficult to form a judgment concerning this plan of action, which, though very natural for calculi, is less so for urethral foreign bodies. It is even difficult to extract pieces of catheters, which are very well adapted for this passage into the bladder, with the aid of lithotrites. I think that we may well hesitate between the manipulations necessary to search for the foreign body (which are very often prolonged and distressing), the disturbance occasioned by the passage of a catheter bent in the urethra, and the dangers of a "button-hole" operation. The physician will usually give preference to the latter method. I do not doubt, that in the hands of specialists who are very skilful in the employment of the lithotrite, this form of extraction is very simple. But this is not true of the physician who does not often have occasion to crush calculi, much less of applying extracting instruments. In conclusion, this ingenious and useful plan should be regarded as a measure to which we should only resort after failure of the others, and in order to avoid a bloody operation.

THIRD METHOD.—EXTRACTION THROUGH ARTIFICIAL CHANNELS.—There are cases in which extraction through the natural passages is impossible or fails. We must then resort to operations which will create an artificial channel for the foreign body.

Formerly, when the methods of extraction were not perfected, this form of treatment was almost always employed. At the present day the surgeon should not resort to it unless the foreign body cannot change its place, and unless its shape, size, and irregularities render extraction through the meatus impossible. What are the foreign bodies which are found under such conditions? They include pins, hair-pins, heads of grain,

or very long and firm bodies which have been left in the canal for a long time, and are covered with incrustations. While they might have been extracted in the beginning, their size makes them disproportionate to the dimensions of the urethra, after they have become the centre of a calculus. The operation is also indicated for those foreign bodies which are situated partly in the urethral canal and partly in the bladder, and which are not capable of being removed with forceps. This plan comprises two measures: one, extraction by puncture; the other, the "button-hole" operation.

1. *Extraction by puncture.—Suë-Dieffenbach's method.*—I have intentionally associated the names of Suë and Dieffenbach because this method, which is known by the German surgeon's name, belongs in reality to the Orleans surgeon, in the same way that S. Cooper's operation was performed and popularized by Boinet.

In order to extract foreign bodies by puncture, Suë and Dieffenbach operated in the following way, the case being one in which a pin had advanced as far as the membranous region. "The obesity of the patient not permitting palpation of the needle through the skin, he was placed in the lithotomy position, and the blunt end of the needle could then be felt toward the anus. With the left hand Dieffenbach made a fold in the perineum, and with the right index finger, which was introduced into the rectum, he pushed the needle through the integument. After the point of the needle appeared outside, it was readily removed with forceps."

Notta of Lisieux succeeded in extracting a needle five centimetres long, which was arrested in the perineum. He armed the tip of the index finger with a steel thimble, which he then introduced into the rectum, and, pushing back the soft parts from behind forward, and from above downwards, he had the satisfaction of seeing the end of the needle pass through the skin. The point presented, it was seized by an assistant with a forceps, and thus withdrawn. It measured thirty-eight millimetres in length. The patient recovered very rapidly.[1]

When the foreign body is situated in the penis, the operation is even more simple. After having steadied the pin or needle with the fingers, the penis is bent upon the point at a right angle, and puncture is thus performed.

When the pins and needles have a very small head or none at all, the operation is of the simplest character, and is not modern. Simple puncture has been performed since the earliest times. In 1773, Deschamps had employed transfixion in order to extract a needle.[2] But transfixion is not applicable outside of these cases. We must, however, make an exception in favor of hair-pins, which are capable of being extracted by Dieffenbach's plan. It was applied in particular by Soulé of Bordeaux, who removed a double pin which had only been introduced four centimetres. Upon forcibly bending the penis, the pressure caused the two points to project through the skin, and he drew the two branches completely outside. He then restored the curvature, and cut one branch close to the skin. Extraction was then easy, and recovery occurred in a few days. Other surgeons have not found it necessary to cut one branch, and, upon restoring the curve, they have been readily enabled to extract the foreign body. In fact, a double transfixion is thus made, and this is sometimes

[1] L'Année médicale de Caen, No. 1, Dec., 1878.
[2] Traité de l'opération de la taille.

produced naturally, as in Ségalas'[1] previously mentioned case, in which both points of a hair-pin had traversed the glans. In the perineum we must operate as Dieffenbach did, by taking the rectum as the point of support of the posterior part of the body. But we must not forget that, if the point of the body is not very sharp, the pressure exercised upon the canal at the other end will be sufficient to give rise to accidents.

The puncture following simple transfixion usually recovers spontaneously without any accident, and without the necessity of adopting any precautions other than rest. The urine resumes its proper course, and micturation is only slightly painful.

2. "*Button-hole operation.*"—Whenever the foreign body is not pointed, or when, although sharp, one extremity is blunt, we must resort to the "button-hole" operation.

This operation consists of an incision which involves the urethral canal, and allows the foreign body to escape. All authors are agreed in giving the incision the shape of a cone, so that the opening of the canal should be as small as possible, in order to avoid secondary strictures and infiltration of urine, and to favor immediate union.

Must we employ anæsthetics during the operation? Authors are in accord upon this point. It is evident that it is well to get rid of the useless contractions of the patients, and of the disordered movements which interfere with manipulations; and the serious annoyance may be met with, as in the following case, of allowing the foreign body to pass into the bladder when anæsthesia is not employed.

Observation.—Catheter in the urethra.—Falling into the bladder during the operation.—Extraction.—Recovery.—A man, æt. 40 years, made use of a new and strong bougie to treat a stricture of the urethral canal. One day he left the bougie *in situ*, and fell asleep. On waking the instrument was no longer visible; it had entered to within an inch of the meatus urinarius. The manipulations to which he resorted resulted, as usual, in forcing it in still farther. A physician, being summoned, made a perineal incision in order to extract it, but the irregular movements of the patient caused it to fall into the bladder. Heurteloup's verberator succeeded in removing it, however, on the following day. The small perineal wound made a good recovery.

The operation is modified according as it is performed upon the pendulous or membranous portion of the urethra. In the first case, the penis is raised, the foreign body is made to project between the fingers, and an incision is made upon it parallel to the urethra. The tractions made to perform extraction must be well considered. The operative manipulation differs slightly when the foreign body is in the membranous region, for it is more difficult to find the part at which it ends, and, when it is partly in the urethra, partly in the bladder, we must necessarily employ a conductor in order to open the canal. If the large, encrusted body is readily found, we can cut directly upon it by making a median incision a few centimetres in length. If, after introducing the finger into the rectum, we can make one end project at the perineum, we should make use of it as a conductor, but in all other cases it is prudent to introduce a catheter into the urethra. Some have employed an ordinary metallic catheter, others Hunter's forceps, etc.

Whatever may be the instrument employed, after the incision of the skin and superficial layers has been effected the surgeon should search for the conductor or foreign body, and cut the canal upon it. Through this

[1] Gaz. méd., 1849, p. 718.

wound he introduces the forceps, which enable him to seize the foreign body and perform extraction.

If strictures are present, he must dilate them by means of internal urethrotomy. This manipulation is not always indifferent, as Notta observed the development of an attack of rheumatism after his incision. This surgeon, after having made the incision, was stopped because the piece of catheter had left the urethra and had fallen into the bladder. He then attempted to produce dilatation through the wound, and, after having introduced a lithotrite, he succeeded in recovering the piece of catheter at one end.[1]

What course should be pursued after the operation? In this respect the tendency of our contemporaries differs markedly from that of the ancients. It has always been agreed that the wound should not be sewed up, but the agreement ceases with regard to the introduction of a catheter *à demeure*. Formerly, the rule was to introduce a catheter permanently in order to facilitate the union of the wound by first intention, and to avoid infiltration of urine. Demarquay also recommended the old practice. At the present time, and especially in consequence of the vigorous protests of Richet, many surgeons have agreed that the catheter *à demeure* is not only useless, but also that it possesses more inconveniences than advantages. According to Richet, the catheter is introduced permanently in order to prevent the escape of urine through the wound, but this will not occur unless the wound is emptied, which is usually not done. The urine, in passing between the catheter and the canal, may also infiltrate the wound. We must also refer to the secretions of the canal, which are increased and vitiated by the presence of a foreign body; by irritating the wound, they favor the development of inflammation. In the second place, the object of introducing a catheter *à demeure* is to prevent the formation of a stricture. But experience has taught that recovery upon a catheter occurs most frequently after suppuration, and this is not a good means of avoiding the cicatricial contractions, which are not obtained after immediate union. Prof. Richet does not use the catheter, leaves the wound to itself, and does not perform catheterism until the end of twenty-four hours, unless the necessity should develop previously. Holmes, Birket, Maurice, Perrin, etc., are advocates of this plan, and I also advise its employment, unless we are compelled to introduce the sound permanently on account of incontinence of urine or cystitis. In this event, we shall use the empty catheter, according to the old teachings.

Demarquay and Parmentier state that they have not found a single case of death after the operation by incision; but, unfortunately, this opinion is erroneous. The unfortunate cases are undoubtedly rare, but they do exist, and I know several in which the operation was followed by accidents, such as urinary and purulent infection. In Spilman's case[2] the symptoms of purulent infection developed after the extraction of a pen-holder. This example is not unique.

In conclusion, the operation by incision is useful when made under proper conditions. Some authors have proposed to make the incision through the rectum, for foreign bodies which are deeply situated in the prostatic portion of the urethra. But this attempt is not justified by necessity, and the transformation of an external into a visceral wound is far from presenting any advantages. In addition, this region is more exposed than the other to the formation of persistent fistulæ.

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[1] L'Année méd. de Caen, I., Dec. 1878. [2] Thèse de Paris, 1871, Bourdon.

The Indications to be followed in the Choice of a Plan of Treatment.—After having mentioned the various methods employed, it remains for me to show the indications which they answer. From this point of view we must divide foreign bodies into regular and irregular ones. Those which are regular and small should be extracted by the first and second methods, when they are situated in the anterior portions of the canal. Those, on the contrary, which are large, irregular, pointed, encrusted, and very deeply situated, almost always necessitate the use of the special measures of the second and third methods. Finally, we must reserve the latter exclusively for pointed and regular bodies when they are fixed in the walls, and for large and deeply situated bodies.

FOREIGN BODIES IN THE MALE BLADDER.

CHAPTER I.

SITUATION OF THE FOREIGN BODIES.—MOBILITY.—FIXATION.

It is important, from a therapeutic point of view, to know what position is occupied by foreign bodies which have fallen into the bladder—whether they have come from without through the urethral canal, a wound, or some abnormal communication with the adjacent organs. Almost all of them usually occupy the fundus of the bladder, into which they fall from their own weight, or from the very arrangement of the organ. It is in this region that the lithotrite and hooks are preferably placed in attempting to extract the bodies.

The exceptions to this rule are rare, and are especially observed when the foreign bodies are long, rigid and flexible, irregular and pointed. Some explanation is necessary in order to show why this large group does not follow the general law. Long and rigid bodies are very often placed transversely, the two extremities resting against the lateral walls of the bladder. Sometimes they are perfectly horizontal, sometimes more or less oblique; it follows, therefore, that they never descend into the fundus of the bladder. It is not astonishing, then, that an exploring instrument may search for them in this situation without discovering them. All pens, pen-holders, pieces of wood, bones, and pieces of metallic catheters, act in this manner. Those whose dimensions are greater than those of the bladder remain partially engaged in the urethra, so that they occupy a constant position, one end being in contact with some point in the upper portion of the bladder, while the other is situated more or less anteriorly in the urethra.

Long and flexible foreign bodies sometimes prove an exception to this rule, and act somewhat differently. When they possess a certain amount of elasticity, like catheters and bougies, they become moulded against the walls of the bladder. But this disposition is not retained for a long time, because the organ, being continually irritated by the abnormal contact, very often contracts and forces the catheter to gather up in a ball.

This arrangement has been observed several times in calculi formed around catheters which had been abandoned in the bladder for a long time. Civiale, among others, has observed several examples. Hence, it becomes evident that this form is very unfavorable to spontaneous expulsion through the urethral canal. Sometimes the more flexible bodies, being stirred up by the contractions of the bladder, may become entangled, and form loops and knots, as happened in the previously mentioned case of a

bougie introduced into the urethra, and which the young man could not withdraw because it had become knotted in the bladder.

Finally, pointed bodies, when they are not very large, sometimes assume the most abnormal situations by adhering to one of the walls. These include pins and needles, which have been found embedded in the summit of the bladder. But here another element intervenes, viz., the mobility or fixation of the foreign body. When the bodies are round or ovoid and very regular, like leaden bullets, fruit-stones, beans, etc., they are movable in the fundus of the bladder; and if we impress upon the latter a lateral movement, as is done in Guyon's so-called indirect manipulations, they become displaced and occupy the most dependent portion of the organ. Affairs take another course when the foreign bodies are long and rigid (pen-holders, crayons, etc.), when they occupy one diameter of the bladder and are absolutely fixed in this position. It is not necessary, in the production of this fixation, that the bodies should be very long, because the bladder contracts upon the objects and renders them immovable. If, however, the object introduced is pointed at one end, this contraction will have the effect of forcing it into the wall of the bladder and thus ensuring its immobility. Usually only one end is pointed, as occurs in pencils, pieces of wood, awls, etc.; this part alone is fixed, while the other, being blunt, rests upon a corresponding portion of the organ without penetrating it. In a case of a copper needle four inches long, mentioned by Chopart,[1] the patient had experienced frequent pains in the buttocks and perineum. It became necessary to perform perineal section. The foreign body was found, with the finger, to be situated obliquely near the neck of the bladder, one end being pushed into the prostate, and the other incrusted end resting against the pubis.

Hitherto I have purposely omitted speaking of the influence of the urine upon the position occupied by the foreign body. This is, however, not without effect, and some surgeons have explained the failure of their attempts at extraction by the displacement due to its presence. Certain bodies float, being lighter than the urine, and, when the bladder is full, are found in the upper part. Now, it is precisely under these conditions that the operation for extraction through the natural channels should be made ; it is not necessary, then, to dwell too strongly on the attempts to seize, in the fundus, a body which is not found there. By tilting the pelvis upward, prehension will be more readily effected. I will have occasion, in discussing treatment, to return to this variety of displacement, which afforded Ségalas the opportunity for a peculiar manipulation.

CHAPTER II.

PRIMARY ACCIDENTS AND SYMPTOMS.

The primary symptoms produced by the presence of foreign bodies in the bladder are usually not very severe. This is proven by the fact that, as soon as they have left the urethra, where they were the source of great pain and serious functional disorders, the patients experience a feeling of

[1] Chopart : Traité des voies urinaires, T. II., p. 111.

very marked relief. The emission of urine occurs more freely than before, and they can satisfy the desire to urinate without apprehending the most acute pains. But this apparent benignity at the outset is not general, and there is no good reason for its occurrence except in cases of small, regular bodies which fall into the fundus of the bladder without producing reflex contractions of the organ. If the body is long and stiff, especially if it presents points or irregularities, like heads of grains, pins, etc., affairs run a somewhat different course. By contracting upon the foreign body, the bladder produces acute pains, which reappear at each contraction and which extend into the hypogastrium and kidneys. In some cases, the pains were so severe that they forced the patient to cry out and to assume the strangest positions. When the body is less offensive to the bladder, the suffering is less intense and only appears toward the close of micturition, while in the previous cases it scarcely presents any remissions.

The primary functional disturbances, when present, are very slightly marked; they are restricted to slight cystitis of the neck, and are evidenced by more or less severe dysuria, incontinence, or perhaps by frequent desire to urinate, recurring twenty, thirty, or forty times a day. At each act of micturition only a few drops of scalding fluid escape, sometimes tinged red by a little blood derived from an erosion of the urethral mucous membrane or from wounds of the walls of the bladder by the foreign body. Free hæmaturia or absolute retention of urine has never been observed in any of these cases. However, a very curious phenomenon is sometimes produced, though rarely in the beginning—I refer to the complete and sudden arrest of the stream of urine during micturition. The slightest movement, or a change in the position of the body, will suffice to cause the stream to run anew. This phenomenon is due to the displacement of the foreign body, which tends to follow the course of the urine, and which then obstructs the cervical orifice, thus intercepting the passage of the fluid.

During the following days, the initial absolute indolence very often disappears to give place to symptoms of cystitis, which are so much more marked the larger and more irregular the foreign body is. Vesical and rectal tenesmus, and constipation, are added to the primary pain. The desire to urinate becomes more frequent, and micturition is accompanied by a sensation of burning in the bladder and perineum; slight fever develops. The urine, which is at first clear or slightly opaque, gradually becomes cloudy and leaves a deposit of mucus. But the cystitis hardly ever, at the outset, passes beyond a moderate stage, and, if it does not subside, becomes chronic.

In conclusion, the primary symptoms may be almost entirely wanting. The surgeon does not often have occasion to observe them, because he does not await their development before interfering, when the introduction of the foreign body is the result of an accident, and especially because masturbators, who are the victims of their passion, never seek the assistance of a physician in the beginning. Whether, on account of an active moral resistance, they prefer to suffer rather than to make a confession, or whether they do not suffer much, as is more probable, these unfortunates do not usually resort to a physician until months and even years after the accident. In addition, none of them refer to the primary symptoms, which pass unnoticed when compared with the gravity of those which they then experience.

Upon examining the numerous cases collected by Denucé, and all

those which I have collected since the publication of his work, I was unable to find a single case of death in the initial stage in man, from perforation, peritonitis, or any other affection.

CHAPTER III.

SECONDARY PHENOMENA AND ACCIDENTS.

Although in the majority of cases the foreign bodies remain in the bladder, there are a small number of exceptions which deserve to be studied, and which explain the division of this chapter into two paragraphs, according as the body is expelled spontaneously, or according as it remains in the bladder for a long time.

1. Spontaneous Expulsion.—Spontaneous expulsion without interference is a rare termination, since among three hundred and ninety-one cases collected by Denucé not more than fourteen examples were found. This is well explained by the nature of the foreign bodies, which are for the most part long, more or less irregular, and very poorly predisposed to pass through the urinary channels.

Furthermore, these bodies are not favorable to spontaneous expulsion because they do not present to the action of the urine a surface of convenient pressure which will enable them to advance under the influence of the vesical contractions. Finally, after a short lapse of time the presence of concretions around them renders their passage much more difficult, either by increasing their diameter or by rendering their surface rougher. Thus, the foreign bodies have sometimes engaged in the urethra, but have then been arrested by a vesical calculous enlargement which prevented the escape of the entire body.

Almost all the cases of expulsion quoted by Denucé relate to small, regular bodies, such as fruit-pits, grape-seeds, anise-seed, etc. The engagement of such foreign bodies in the urethral canal is readily understood, and the pressure of the stream of urine causes them to escape rapidly. I will have occasion, in discussing gunshot wounds, to quote several curious cases of foreign bodies expelled in this way, such as fragments of cloth, bone, etc. In speaking of those which have passed from the intestines to the bladder, I have mentioned some singular cases demonstrating at the same time the possibility of a very considerable dilatation of the canal, and, on the other hand, the fortunate tendency which these migratory bodies possess of being eliminated in this way.

But, despite the unfavorable conditions in the male genito-urinary organs, which are very inferior in this respect to the female organs, examples of the expulsion of long foreign bodies are not wanting, and since Denucé's treatise I have been able to collect a certain number. Some refer to pieces of catheters, which are the most common; others to more irregular bodies, such as pieces of bone, debris of instruments, and even a watch-chain.

Observation.—Expulsion of a splinter of bone.—"A young boy sustained a fracture of the pubis and rupture of the bladder, from which he recovered. Two weeks after the accident, a splinter of bone two centimetres long was passed through the urethra." (Union médicale, 1858, p. 328.)

Bourdon reports a still more curious case, which was observed in 1870, Demarquay's service:

Observation.—Spontaneous expulsion of a pen-holder.—"The end of a pen-holder was broken in the bladder. The surgeon decided to perform perineal section, but on the following day the body, which had been expelled spontaneously, was found in the urine." (Bourdon. Thèse de Paris, 1871.)

The following very interesting example shows that this expulsion may occur when the bodies are very irregular and flexible, as an effect of chance, if one end presents properly in the neck of the bladder.

Observation.— Watch-chain in the bladder.—Spontaneous expulsion.—"A young man amused himself by tying a watch-chain of galvanized metal to a wire and introducing it into the urethra. The chain passed into the bladder, in consequence of the absorption of the canal, and perhaps also of the manipulations of the young man. The wire projected outside of the meatus, but it was attached, unfortunately, to the middle of the chain, so that all efforts at removal only resulted in bending it into two parts. The wire broke in the midst of these tractions, and lithotomy was contemplated; but previously he was made to drink copiously and retain his urine. He had the good fortune to pass the chain with the urine; it had passed through the canal, on account of entering it end first." (Phila. Med. Times, 1872.)

Finally, worn and roughened bougies have been passed from the bladder, as is shown by the following case:

Observation.—Spontaneous expulsion of a worn bougie which had fallen into the bladder.—A worn bougie, which a man had used for thirty-four years in treating a stricture, fell into the bladder. A sound, which was introduced into the bladder two days later, revealed nothing abnormal. Six days afterward the patient was unable to urinate, and a physician, being summoned, attempted to introduce a catheter, but encountered an obstruction half an inch from the meatus. He introduced a pair of forceps and withdrew the bougie, which had become roughened. Thus, the unaided contractions of the bladder had sufficed to expel the foreign body." (Langenbeck's Arch.: T. X., p. 537.)

2. Prolonged Stay of Foreign Bodies in the Bladder.—1. Incrustation of the Foreign Bodies.—One pathological event is predominant in the entire history of the foreign bodies which remain in the bladder for a long time; this is the formation of calculous incrustations, which are gradually deposited upon them and give rise to an entire group of symptoms which are almost identical with those of ordinary calculi. This gradual modification deserves a special study, and is interesting with regard to its manner of production, its causes, varieties, and the influence which it exerts on the course of the affection.

As soon as a solid body is left in the bladder, it becomes, after a variable length of time, the site of the deposit of earthy, cretaceous and calcareous substances, which form a layer on its surface that is generally uniform. Even the removal of catheters *à demeure*, which have been left in place for a few days, demonstrates this fact; but it has also been confirmed by the extraction of bodies which have remained for some time. Thus, in some cases, a foreign body which has remained for forty-eight hours in the bladder, has already presented manifest traces of urinary concretions. At other times, extraction performed after the lapse of a few days, either by lithotomy or through the natural channels, does not enable us to recognize any concretion. The condition of the bladder prior to the accident, and the qualities of the urine itself, may evidently modify, to a considerable extent, the period in which the first layers of

the deposit make their appearance. Now, this circumstance is not by any means rare in cases of therapeutic origin, since these cases refer to individuals who had been treated for affections of the urinary passages at the time of the accident. It is undoubted that, in persons whose naturally highly charged urine deposits readily, concretions are formed more quickly than in others.

How does this curious and general incrustation form on all the bodies introduced into the bladder? Ferguson, struck by this strange phenomenon, thought that "the ordinary formation of a calcareous deposit on the surface of a body which has remained in the bladder cannot be explained by the peculiar qualities which the renal secretion assumes, as the urine continues to flow with the same chemical properties as before." Unfortunately, the basis on which Ferguson's notions rest is not exact, and the change in the composition of the urine, after the presence of a foreign body, had been previously admitted by the most competent authorities on diseases of the urinary organs. "One of the most constant phenomena, says Civiale, is the variable change in the composition of the urine. We almost always find that the phosphatic element soon predominates in great abundance." It is necessary to wish *not* to observe in order to deny this curious change, which, though very slightly marked in the first few days, keeps on continually increasing, until not only the intimate composition, but also the physical properties of the urine are changed. It becomes cloudy, and deposits at the bottom of the vessel a layer of sediment which presents a characteristic appearance. Can we determine in what this consists and by what mechanism it is produced? It is impossible to settle this question in the present condition of science, because

FIG. 50.—Pen-holder which fell into the bladder and had begun to undergo incrustation. (After the Gaz. hebdom., 1847.)

we possess no experiments on this interesting point of pathological physiology, and experimentation is very difficult. Moreover, where is the change produced? Does it exist at the moment in which the urine reaches the bladder, or is it produced in this reservoir, which is no longer under its ordinary conditions, which is irritated and often the seat of an acute or chronic inflammation, whose mucous, sanguinolent, or purulent products are mingled with the urine?

I have many and many a time explained this process, which appears to me to be as rational with regard to the bladder, as with regard to any other glandular canal. There must be a previous alteration in the urine. In other words, it does not become charged in the bladder with a quantity of phosphates which is out of proportion to the normal amount. It is impossible that chemical decomposition can give rise to such a quantity of phosphatic salts, and only a disturbance of the mysterious properties of the renal filter can explain this singular phenomenon. I do not know whether both kidneys participate at the same time and to the same extent in the production of this alteration. In order to explain this process, we must admit the law of the sympathetic alteration of the secretions. Here, as in the urethra, the prolonged contact with the bladder will produce a reflex irritation of the kidney, an irritation whose essence is unknown (but some idea of which is obtained by physiological experi-

ments on the glandular nerves) and which will give rise to the elimination of a quantity of phosphates and calcareous salts in a much larger proportion than normal. There is also another point which remains to be studied. The view that this alteration is of renal and sympathetic origin is substantiated by the fact that it ceases as soon as the foreign body has been eliminated, and that even in cases in which, on account of its presence, the bladder is the seat of a chronic change, the phosphates disappear at the end of a short period together with the cause which produced the cystitis. Finally, in some cases, death has been the result of the prolonged stay of foreign bodies in the bladder, and renal changes have almost always been observed out of proportion to the simple transmission of vesical inflammation by propagation.

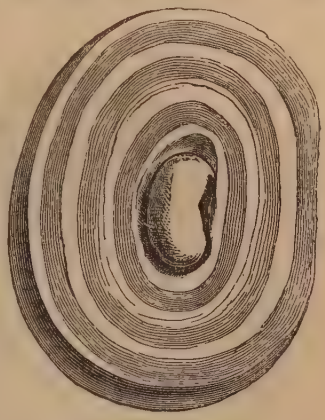

Fig. 51.—Ovoid calculus formed around a bean (after Morand).

Peculiarities are not found wanting, however, if we leave the formative process in order to study the mode of deposit. We must also explain the special selection of salts with which the urine is charged in cases of foreign bodies in the bladder, as an attraction of a peculiar nature exists, and is observed even before the urine settles. Every one knows that the end of a catheter *à demeure*, which has been retained for several days, becomes covered with deposits which are not usually found in the urine. Furthermore, certain substances do not appear to act like others with regard to these deposits, and present a number of very curious phenomena. While the layers are formed uniformly on some, they are deposited by preference, on the contrary, upon certain parts of others. This peculiar disposition has been observed at all periods, both at the outset and also upon old calculi which have remained in the bladder for several years.

Shape plays a preponderating part in this respect, and we may refer all concretions formed around foreign bodies of every description to five principal types.

1. Spherical or ovoid calculus surrounding the foreign body.
2. Fusiform calculus within a foreign body (pen-holder, etc.).
3. Tomahawk calculus with two terminal enlargements.
4. Calculus in the shape of a club at one end of the foreign body, the other being free.
5. Bead or cluster calculus.

These five varieties correspond, as we shall see, with the shape of the foreign body, and in all those which are regular, more or less spherical and ovoid, the concretion assumes an analogous shape. Those, on the contrary, which are long, flexible, or stiff, assume various shapes which it is useful to know, because they may, to a certain extent, explain the reason of the difficulties which the surgeon experiences in extracting them. When the bodies are rigid, such as wooden or metallic pen-holders, crayons, pieces of metallic catheters, the spindle shape is by far the most common. The deposit begins at the centre, increases at this

point, and finally assumes an ovoid shape. The accompanying cuts furnish an idea of this type.

To what shall we attribute the immunity of the ends? Must we regard it as the effect of a natural selection of the phosphates for the middle part, or must we look for its explanation in a mechanical phenomenon? I am more inclined to adopt the latter view. I believe that the contractions of the bladder upon the ends of these bodies will prevent their incrustation if they are long, and the friction of their ends, if they

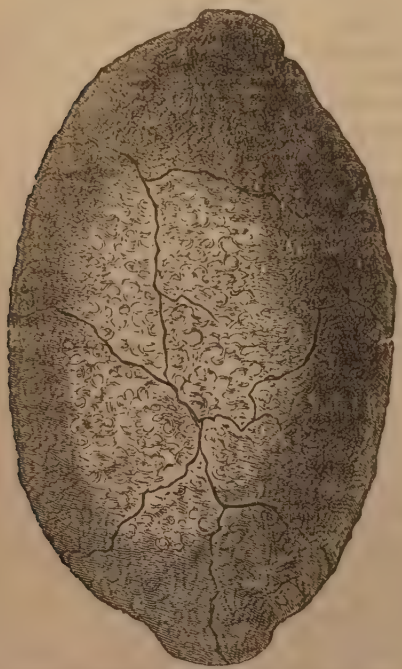

FIG. 52.—Fusiform calculus formed around a piece of wood represented in Fig. 53.

FIG. 53.

FIG. 54.—Brass pin found in the same bladder (Bouisson: Tribut à la chirurgie).

are short, will also oppose the incrustation. It is not necessary that the foreign body should have a very considerable diameter in order that this deposit may be formed and assume a certain consistence; this is sufficiently proven by the following example:

Observation.—Fusiform calculus formed upon a needle.—"A young peasant had introduced into his urethra, in accordance with the advice of a shepherd, a large sewing-needle which belonged to a girl whom he desired to have fall in love with him. As he presented symptoms of stone, he was brought in 1758 to the Hôtel-Dieu of Chartres, and a stone of the size and shape of a large nut was removed from the bladder by the operation of lithotomy. It was found to be traversed by a needle, the two roughened ends of which projected from it for a few lines. The patient recovered." (Deschamps, quoted by Chopart: Traité des malad. des voies urin., T. II., p. 3.)

But, if the object is not very long, like a needle or small piece of wood, the deposit continues to form, involves the extremities more and more, and becomes fusiform, so that, after a long period, the entire body

may be enclosed in the calculus, which then assumes the shape of a small lemon. Paré saw this variety of incrustation around a needle with which "seamstresses usually sew."[1]

Bouisson has also pictured a beautiful example which formed around a piece of wood (Fig. 52.)

Guy's Hospital possesses a large calculus, in the centre of which a pipe-stem is found. A. Cooper saw one of these concretions which contained in its centre a silver toothpick.

The third type, the oblong concretion with enlargement at both ends, is much rarer, and only a few examples have been observed.

Vicq d'Azyr presented to the Medical Society of Paris a calculus formed upon a piece of wood which was oblong and constricted in the middle. The concretion had undoubtedly formed at both ends, and, increasing little by little, became united at the centre. But the latter is the rarest of all varieties, and it is difficult to explain this peculiarity on mechanical principles.

FIG. 55.—Ivory needle incrusted with phosphatic deposits at one end (after Morand).

The fourth type, which is very frequent, is chiefly observed on pointed foreign bodies, which terminate at the other extremity in a head or blunt end. These include pins with glass or ivory heads, hair-pins, etc. This arrangement is often mentioned by authors. Thus, Pinet extracted, by lateral lithotomy, a stone which had as a nucleus a large, pointed, black pin, the largest portion of which, on the side nearest the head, was enclosed in the calculus.

The points of the foreign bodies are rarely involved. This is due to the slight hold which they offer to the deposits, to the friction to which they are subjected, and also, in some cases, to their penetration into the walls of the bladder. Moreover, these foreign bodies are not alone under these conditions, as we also find fusiform calculi in the second group, whose ends are free.

This group also includes the mixed foreign bodies which are partly situated by one end in the neck of the bladder and the prostate. Only the portion in the bladder is covered with incrustations, while the other is always free. If the body is hollow, the deposits occur in the interior, but never externally throughout the entire urethral portion.

Finally, the most curious arrangement is undoubtedly that observed on long and irregular foreign bodies like heads of grain, flexible twigs of plants, etc. Nicaise had occasion to remove one of this kind from the bladder of a man seventy years old.[2] With the aid of a spoon-shaped lithotrite, this surgeon succeeded in removing a piece of corn-straw seventeen centimetres long, which had remained in the bladder for ten days. It already presented traces of deposit in places. The concretions formed upon this class of objects are characterized by their beaded arrangement.

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[1] A. Paré: Œuvres, liv. XXV., ch. xv.
[2] Bull. de la Soc. de chirurgie, 1875.

Morand relates that an old man sixty-two years of age had introduced a head of wheat into the urethral canal for a pretended therapeutic purpose. It passed into the bladder, and it afterward became necessary to perform lithotomy, which permitted the removal of a sort of cluster calculus.[1]

The incrustation was even more marked in the following case, which I owe to the kindness of Dr. Dayot of Rennes. This case is very inter-

Fig. 56.—Cluster calculus formed around a head of wheat (after Morand: Mém. de l'Acad. de chirurgie).

esting, both on account of the success which attended the interference of the surgeon as well as on account of the peculiar form of the calculus:

Unpublished observation reported by Dr. Gringoire, interne.—Stem of a plant which became the centre of a "cluster" calculus.—Perineal section.—Lithotrity.—Recovery.—J. A——, æt. thirty years, entered the Hôtel-Dieu of Rennes on March 25, 1878. He stated that in the month of August, 1877, he had a fall from a high place, in consequence of which he micturated blood, and since which time he has suffered from pains, sometimes very intense, in the hypogastrium, and radiating toward the perineum and the region of the kidneys. Dr. Dayot diagnosed a vesical calculus, and the operation of cystotomy was performed on March 30th. The calculus was extracted, or rather, numerous calculi were removed from the bladder, which were fixed at some distance from one another upon a stem 0.15 m. long. They constituted a string of calculi, some of which were as large as a nut, others the size of a pigeon's egg. The patient made a confession, and stated that he had introduced the stem into the canal. For the first few days the symptoms ran a regular course, and then it became necessary to make injections on several occasions in order to free the wound of the gravel which obstructed it. At the end of twelve days cicatrization was complete and the patient urinated freely through the canal.

The patient was convalescing when fresh pains reappeared; the urine flowed with difficulty, and the stream was at times suddenly interrupted. Dr. Dayot introduced a lithotrite and succeeded in seizing the small calculous nucleus which had been left in the bladder. The pains disappeared, and the patient left, cured, on the 6th of May.

There is only one step from this variety to the existence of multiple calculi forming around nuclei, which are merely fragments of a body which had been introduced whole. In fact, when the stem is of vegetable origin and readily broken, like certain kinds of straw, the mere occurrence of vesical contractions may give rise to their division, and the calculous matter will be deposited on all parts. In a case reported by Norris,[2] a straw had been introduced into the bladder. The calculi were not discovered until the fourth examination; the patient was in too low a condition to bear an operation, and died ten days later. Upon examining the bladder, which was small, five calculi placed alongside of one an-

[1] Morand: Mém. de l'Acad. royale de chirurgie, O. 5.
[2] Guy's Hospital Rep.

other, representing elongated cylinders without facettes and all formed around pieces of straw, were found immediately behind the prostate, which was doubled in size.

The reverse phenomenon has also been observed. Thus, the editor of the History of the American War states that Prof. Gross, of Philadelphia, has in his possession the three caudal vertebræ of a squirrel, which were found in the centre of a calculus. It had been extracted by lithotomy from the bladder of a man thirty-five years old, who was addicted to bad practices.[1]

It happens, in very rare cases, that a piece of the concretion is separated from the general mass and becomes the centre of a calculus ; this phenomenon has been observed with regard to a bullet, but not with regard to other bodies. These nucleated calculi hardly ever attain a very considerable size, and when they have acquired a diameter of three, four, or five centimetres, their growth is arrested, although this does not prevent the urine from being continually loaded with cretaceous matter. Usually the deposits, which form after the calculus has arrived at the stage of quiescence, are eliminated with the urine. But it sometimes happen that they remain in the bladder and coat the walls of the organ to a greater or less extent. In Richerius' case there was a large amount of fine sand in addition to the foreign body.

Before concluding our remarks with regard to the shape, I will say a few words with regard to the appearance presented by very long and flexible bodies like catheters. I have previously had occasion to show that they may bend on themselves. A beautiful illustration was presented to the Society of Medicine of Paris in 1780.

Observation.—A catheter had been entirely swallowed by the urethral canal of an individual. He was cut for a calculus ten months later, by White, who removed a stone weighing two and a half ounces, very hard and of a light brown color externally. When it was sawed in two, a whitish substance, and the bougie which had acted as a nucleus during its formation, came into view. It was folded on itself and twisted into a small knot. (Soc. médicale de Paris, 1780.)

Chopart has also seen a catheter forming the centre of a calculus, which had the shape of a chestnut and was composed of a very soft substance.

I will not dwell long on the physical properties of these concretions, restricting myself to recalling the fact that they have a great resemblance, in many respects, to ordinary calculi. Perhaps they are somewhat more friable, and this consideration is not unimportant with reference to the application of lithotrity to the extraction of these foreign bodies. The concretions are usually formed of concentric layers, alternately of different colors, sometimes white, sometimes brown or grayish, never black. These various colors are due to the fact that the deposits contain organic matters in variable quantity, and are affected by the condition of the mucous membrane. When the bladder is not very much inflamed, the deposit is creamy white ; it becomes darker when it has been irritated by the contact or the irregularities of the body.

According to various authors, their composition is the same as that of ordinary calculi, and they contain phosphates of lime, ammonio-magnesian phosphate, urates of lime and ammonia, and organic matters. We must not imagine that these salts are found equally in all concretions, as they

[1] War of the Rebellion, T. II., p. 277.

are present, on the contrary, in very variable proportions, although it is impossible to determine the cause of this diversity.

All authors are not agreed upon the question of the immunity of some bodies from incrustation in the bladder. Some believe, with Nélaton, that certain substances, such as wax, are never incrusted. The observation of a considerable number of cases studied with reference to this question has proven that no substance is completely free from vesical incrustation, though all are not equally predisposed to it. Thus, in a general way, the nobler metals are less readily incrusted than others; these include gold, silver, etc. On the contrary, metals which are eminently oxidizable, like iron, substances of vegetable origin, pieces of wood, catheters and bougies, are promptly incrusted. Glass very rarely forms the site of very large and stable concretions, and, in the cases quoted by authors, glass tubes never constituted the nuclei of calculi, like pen-holders or pencils. Some cases analogous to the following have led to error, and appear to indicate that glass possesses a certain immunity.

Observation.—Glass tube in the bladder.—A young man from Havre presented himself in 1839, in Necker's service, for calculi, carrying in his bladder the fragments of a glass tube, which he pretended to have introduced into the urethra for the mere purpose of amusement. This tube, although it had remained in the bladder for nearly six weeks, presented no traces of calculous deposit. (Gaz. méd. de Paris, 1840, p. 707.)

Civiale has had occasion to observe a case of incrustation around the tube of a barometer, which had entered the bladder.[1] There is, therefore, no absolute immunity of certain bodies from incrustation, but merely a less marked disposition thereto. Perhaps, according to Ferguson, an exception will have to be made in favor of fragments of the calculus, when they become detached from the foreign body. He lays down the rule of the rarity of secondary incrustations around fragments which the lithotrite often leaves in the urinary reservoir. Finally, when he endeavors to explain this fact, he is obliged to admit that the renal secretion may act very differently in different cases.

Symptoms of Incrusted Foreign Bodies.—We have seen that the primary symptoms are usually very slight, and that the patients almost always experience relief when, after having left the urethra, the foreign body falls into the bladder. This tolerance sometimes persists for a very long time. Despite the formation of deposits upon the forgotten object, they may resume their vocations and believe themselves out of danger. Is it not curious to find a pen-holder remaining in the bladder for four years before producing any accidents? Nevertheless, such a case has been observed, and I will have occasion to revert to this observation in showing the gravity of the secondary symptoms compared with the initial benignity.

Sometimes the patients experience no suffering. They notice that the urine is cloudy, but this does not appear very surprising. Some have believed that the fine gravel which they passed in the urine was merely composed of pieces of the foreign body, and regarded this phenomenon as a favorable symptom.

Apart from these exceptions, which are moreover very rare, the concretions formed around foreign bodies manifest their presence by a com-

[1] Gaz. méd. de Paris, 1841, p. 744.

bination of symptoms common to all calculi, but which are not always associated in the same patient.

From the special point of view referring to this question, we may divide the symptoms produced by nucleated calculi into three periods.

In the first, or period of increase, the affection, which is compatible with the proper performance of the functions, reacts but little upon the organism. The second period begins at the time in which the calculus, having arrived at its full development, produces severe local and functional disturbances around it. Finally, the last period, to which I will apply the term period of marasmus, is characterized by progressive emaciation, by profound disturbance of health, and by local disorders so severe as to be incompatible with life.

I hasten to add that the patients rarely arrive at the stage of marasmus, because the sufferings which they endure oblige them to demand the assistance of our art, and active surgical treatment relieves them very quickly. It is very difficult to find many examples belonging to this last stage, for the old observations, more numerous than the modern, are often too incomplete to enable us to base a valuable investigation upon them.

First stage, or period of increase.—After the foreign bodies have remained in the bladder for a few days, the pains increase slightly, the symptoms of cystitis develop, if they have not existed previously; but they are usually very slight and fugitive, and do not cause much inconvenience. The desire to urinate is felt somewhat more frequently than in the normal condition. The patient experiences pain during the efforts of micturition—sometimes dull if the body is blunt and heavy, sometimes sharp if it is pointed or irregular, like a needle, a whittled piece of wood, etc. He sometimes experiences in the penis, and especially at the extremity of the glans, a peculiar reflex sensation, a pricking which compels him to pull upon the part, and thus acts as a cause of frequent erections. The patient passes a very good night, but in rare cases he is obliged to get up several times in order to urinate. If the cystitis increases, an acute pain appears in the hypogastrium, which increases on pressure, efforts, etc.

The desire to urinate becomes much more frequent and the character of the excreted fluid is changed. At first clear or slightly cloudy, it becomes sanguinolent in some cases, is passed with difficulty, and leaves a deposit, at the bottom of the vessel, of a more or less deep layer of pus, mucus, and thick, yellowish, earthy deposits. The characteristic appearance in calculous formation is the cloudiness of the urine, which is ammoniacal and does not become clear after standing.

Fever very rarely develops during the first stage, the duration of which may be very long, varying from a few months to a year or more. The general condition is not affected, and the health remains good. I do not think that the symptoms are more rapid in cases of foreign bodies than in ordinary calculous affections, the beginning of which cannot be determined exactly.

In conclusion, this first period is characterized by functional disorders, slight cystitis, pains in the glans, cloudy urine, dull or sharp pains.

Second stage, or period of quiescence.—When it has arrived at its full development, the calculus produces much more marked disorders. The symptoms are the same as the preceding ones, but they become alarming on account of their intensity, duration, and increase. The dysuria, which is slight and temporary in the first period, becomes persistent, and the patients are continually occupied in satisfying the incessantly repeated desire. They constantly experience the desire to urinate, and their ef-

forts, which are accompanied by the most terrible pains in the abdomen, kidneys, and perineum, only result in the expulsion of a few drops of scorching, cloudy urine, which is very often sanguinolent. The dysuria and desire to micturate continue day and night. At the end of a certain length of time, incontinence develops either from overflow or from atony of the bladder, which cannot contract without causing horrible suffering.

The symptoms do not always run the same course, and it is not rare to find that the patients are unable to urinate except by assuming the strangest positions. Some crouch like individuals who have foreign bodies in the rectum and who make violent efforts to go to stool. Others can only succeed in diminishing their pains by lying on the knees and elbows, in the most fatiguing and abnormal positions. The majority experience, in urinating, a phenomenon which is peculiar to those suffering from calculi. I refer to the sudden retention, which is due to the fact that the calculus, by presenting at the neck of the bladder, prevents the discharge. In a little while the urine reappears when the foreign body has changed its position.

During this entire period the cystitis usually remains chronic, and presents exacerbations, being produced by the presence of the calculus ; it is increased by the friction of the points or ends of the foreign body. The mucous membrane, which is profoundly changed, suppurates and leaves in the urine gangrenous shreds, which are deposited with the pus and phosphates at the bottom of the vessel. The signs of nephritis are not rarely observed in this stage, and are characterized by pain in the kidneys, a more profound change in the renal secretion, the presence of casts in the urine, and sometimes by remote general symptoms.

The urine is still very abundant, always cloudy, sometimes sanguinolent, highly charged with yellowish white deposits, and exhaling a strong ammoniacal odor, even at the moment at which it is voided from the urinary reservoir.

It is usually in this stage that the patients, who have not previously demanded the aid of art, present themselves to the physician ; and when they conceal the origin of their mishap, they are treated for ordinary calculi, with which the disease may be confounded, the calculous affection, in the majority of cases, completely effacing the symptoms peculiar to the foreign body.

We very rarely encounter, in the stage of quiescence, the grave local complications, such as perforations, peri-vesical abscesses, rectal or perineal fistulæ, etc. These accidents almost always belong to the last stage, in connection with which I shall study them.

Third stage, or period of marasmus.—When left to themselves, foreign bodies of the bladder, which have become nucleated calculi, will produce death after a longer or shorter period, if art does not interfere to remove the calculus.

Little by little the general condition is changed, and the patients waste away, a prey to the most intense suffering and to insomnia; the appetite disappears, emaciation progresses rapidly, and the entire body assumes a characteristic tawny yellow appearance.

The genito-urinary organs present a peculiar appearance, which was noticeable even in the preceding period, but to a less marked extent. The penis is long, hypertrophied, and flaccid; the prepuce acquires extreme dimensions in certain of them, as in the case quoted by Bouisson.[1] The hair

[1] Traité à la chirurgie, T. II.

on the pubis becomes sparser while the root of the scrotum and the base of the penis form an abnormal projection, which is so much more striking as the patients have arrived at an advanced stage of emaciation. Upon approaching these unfortunates we find that they exhale a fetid, very ammoniacal odor, due to the incessant discharge of the urine which the weak bladder can no longer retain. The altered urine dribbles away night and day, soiling the adjacent parts, the thighs and clothes, and causing the putrescence. At this stage locomotion becomes impossible, the most trifling movements producing intense pains. Even the efforts of defecation are very painful, and we must continually combat the obstinate constipation. Fever gradually develops, at first at night; the kidneys become affected, the limbs become œdematous, ascites and diarrhœa appear, and death occurs from marasmus and cachexia.

Roux's observation.—Bone of mutton.—Lithotomy.—Death.—Pierre Legrain, shepherd (Seine-et-Marne), was cut, at the age of fifty, in the Hôtel-Dieu, by Dupuytren, for a calculus which had formed around a foreign body, which he stated was a wisp of cotton, but which was, in reality, a small stick of marshmallow root. He made a good recovery. In 1838, five years later, he entered Roux's service in the same hospital. He presented himself for the removal of a bone of mutton which he had in the bladder, and which he used, as he stated, instead of a sound. At his previous appearance, the genital organs were intact, while, at the second, the urethral canal was divided along its whole length from the meatus to the origin of the scrotum. The edges of the solution of continuity were not united, and presented notches, which indicated so many blows of the instrument which had been used for dividing it. At the lower part was found a large opening, through which the urine flowed, and into which the patient was in the habit of introducing the bone, which had fallen into the bladder a few months previously. Condition of extreme emaciation; slow, dull intelligence; he refused to give any details with regard to the origin of the genital mutilation. The patient was operated on by Roux. The bone removed from the bladder was cylindrical, two inches and two lines in length; its ends were blunt, and rounded as if with an instrument. The middle part presented a fusiform phosphatic concretion. He died two days later, having retained complete consciousness, and without any symptoms of peritonitis or any other accident. At the autopsy nothing was found but a very large ulceration of the vesical mucous membrane, which was apparently of old date, and a slight extravasation into the peritoneal cavity. (Bull. de thérapeutique, T. XIV., p. 320.)

Various Complications.—All these accidents are common alike to ordinary calculi and to foreign bodies which have become the nuclei of calculi. But there are, nevertheless, a certain number of complications which develop during the course of the latter affection.

Almost all these complications are the result of lesions of the walls of the bladder, produced by the presence and friction of the irregularities or extremities of long, rigid, or pointed foreign bodies. We entertain a wrong idea if we consider them frequent, and, even apart from ovoid and regular foreign bodies which do not produce these effects, those to which we have reference only exceptionally wound the bladder to such an extent as to produce serious accidents. Civiale observed this fact a long time ago. "Some needles," he says, "despite a length of five or six inches, have remained in the bladder for a long time, although the ends have not become covered with calculous matter, and they do not give rise to any mechanical lesion. Only in a small number of cases have they perforated the walls of the bladder, and thus projected into the perineum, hypogastrium, or rectum."[1] However, it has very often happened that in performing lithotomy the surgeon has been able to determine that

[1] Gaz. méd., 1838, p. 269.

one end of the foreign body was imbedded in the walls of the bladder, and at other times in the prostate gland. The accidents had undoubtedly not yet appeared, but the very intense pains of which the patients complain were prodromal signs. The continuous pressure of the walls of the bladder upon the two extremities of a rigid body produces, in one or two opposing points of the bladder, gangrenous ulcerations, which may suffice to produce the most severe accidents and purulent infection. This variety of perforation is sometimes produced at an early period. Thus, it was present on the twenty-eighth day in Terrillon's observation, which will be found farther on. If the perforation is sudden, as sometimes happens when the foreign body is pointed, and if it takes place at a point covered by the peritoneum, fatal peritonitis will result, and death soon occurs. Rendu saw a case which was observed in Péan's service. If the body is blunt, and the perforation is the result of successive contractions, an inflammation develops in the vicinity, and terminates in the formation of a peri-enteric abscess prior to the perforation, which sometimes denudes the walls of the bladder over a large surface. The following case by Terrillon is an example in point:

Observation.—Pencil introduced into the urethra and bladder.—Attempts at extraction.—Peri-vesical abscess.—Death.—Terrillon had under his care a man, aged fifty-four years, who had introduced a pencil into his urethra twenty-eight days previously. This body had remained in the canal for two weeks, and at the end of that time had passed into the bladder. On the twenty-eighth day he had some chills. Nevertheless, attempts were made to crush the stone for two days in succession. After each attempt the patient had violent chills at night, and intense fever. On the thirty-third day Terrillon performed lithotomy and removed the pencil. However, the symptoms of purulent infection continued, and the patient died on the seventeenth day after the operation, the fiftieth since the introduction of the foreign body. At the autopsy, in addition to the lesions of purulent infection, a peri-vesical abscess was found, with perforation of the bladder, produced by the muscular contractions upon the foreign body. (Bull. de la Société anatomique de Paris, 1873, p. 651.)

At times the efforts made by the physician to displace a long and rigid body are not indifferent with regard to the production of perforations, and these manipulations explain their multiplicity. In the following case, which is very interesting from more than one point of view, there were no less than four perforations; the older ones had followed the process described above, and abscesses had formed in their vicinity. No illustration will show better than the preceding one the gravity of these collections, which expose the patient to purulent infection, infiltration of urine, and to peritonitis.

Observation.—Pen-holder in the bladder.—Various accidents.—Death.—A man, æt. twenty-six years, had introduced into the urethra a pen-holder which passed into the bladder. There was almost complete tolerance for about four years. At the end of this time, a fatiguing ride on horseback produced fever and perineal pain; the urine soon escaped through the rectum and not through the urethra. The patient confessed that he had introduced a pen-holder. Three attempts at lithotrity were made without very great success. At the fourth the lithotrite seized the end of the foreign body and the invaginated portion was withdrawn; it measured three centimetres and a half in length. Other attempts to remove the remainder of the foreign body, which were made a few days later, failed and caused great pain as soon as the object was grasped. The health, nevertheless, remained good until, after a carriage-ride, very severe inflammatory symptoms supervened; fever developed, the patient passed a large amount of pus per rectum, and died three weeks after his imprudence.

Autopsy.—Four perforations were found in the bladder; the oldest one was situated at the bottom of the vesical cul-de-sac; it was round, with cicatricial edges, as large as a franc, and led into an irregular pouch filled with pus and urine, which was as

large as a hen's egg. It had opened through an orifice into the rectum, which was healthy. The second perforation was at the apex of the bladder, smooth, regular, old, and leading into an irregular cavity filled with urine and pus. The other two perforations were situated to the right and left; the edges were ulcerated, torn, red, and inflamed, communicating with two large spaces in which the urinous infiltration had burrowed. The foreign body, which measured eight centimetres, was at first placed vertically in the bladder. It became displaced on account of the incrustation, and had assumed the horizontal position, as was shown by the more recent lateral perforations. The calculous layers were deposited around the pen-holder. (Caudemont: Bull. de la Soc. anat., 1850, p. 354.)

The perforation sometimes leaves no apparent traces, and it is difficult to determine the cause of the lesions if we do not know the primary accident. This occurred in a case observed at the Charité, in which we may suppose that a needle had given rise to purulent injection and death, either by producing peri-vesical phlebitis, or by piercing an adjacent organ.

Observation.—Curling needle in the bladder.—Pyæmia.—Death.—A man entered the Charité with symptoms of purulent infection, from which he died. Among other lesions, extensive phlebitis was found, involving the vena cava and the veins of the right lower limb, which contained softened clots and pus; small abscess in inferior portion of gastrocnemius muscle on this side; extravasation with considerable false membrane in the left pleura; fifteen metastatic abscesses in the lungs. Finally a large, black frizzing needle, three inches long, was found in the bladder, whose lining membrane was thickened, and which contained puriform urine. It was fixed by its point into the posterior wall of the bladder, and encrusted with phosphate of lime along the half of its length. (Archives de médecine, 1re série, T. 19.)

Perforation of the rectum.—The continual pressure of the calculus, or the ends of the foreign body, sometimes leads to abscesses in the cellular tissue, which covers the prostato-peritoneal aponeurosis posteriorly. The resulting accumulation opens either into the perineum or rectum. But, despite the large number of cases observed, there are only a few in which the vesico-rectal communication has been well established. It was present in Caudemont's case, which was reported above. In a much more recent case, which has been communicated to the Surgical Society, the vesico-rectal fistula was produced at an uncertain period, though apparently very early.

Observation.—Rupture of a catheter in the bladder.—Exit through the rectum.—A man, æt. seventy-eight years, had undergone, in 1863, a lithotrity which was performed by Civiale. After this time he was unable to pass any urine without the aid of a catheter. One day, upon withdrawing his metallic catheter, he found that it was broken, and the urine was stopped by the portion remaining in the canal. The patient then took a fresh catheter and forced the fragment of the first one into the bladder. Four hours afterward the foreign body was found, on examination, to be in the bladder. Fleury, on being consulted, advised the expectant plan of treatment, basing his opinion on the impossibility of extraction through the natural channels, and the dangers of lithotomy at such an age. Moderate inflammation set in, and four days later, during an effort which the patient made to go to stool, the end of the catheter, seventeen centimetres long, became engaged in the anus. A few tractions sufficed to remove it. Recovery. (Soc. de chirurgie, 1878.)

Such an event is very abnormal and almost unique in literature. The conscientious surgeon must not, however, rely upon such a termination, and in particular he must not base an expectant plan of treatment, which is almost always pernicious, upon the possibility of such a chance.

Fleury has reported another case of perforation which is no less curious; it was probably the result of an abscess formation between the blad-

der and rectum, under the influence of the irritation or of the perforation produced by a shoemaker's awl, which had remained in the bladder for fifteen years, and had become the centre of a calculus. The mode of entry of this body is obscure, but it is probable that it was forced through the urethra. The finger, when introduced into the rectum, clearly distinguished the situation of the vesico-rectal perforation; furthermore, the patient from time to time passed gas and frothy urine through the urethra.[1]

If the patients, being still robust at the time in which the perforations and abscesses developed, can withstand it, the pus, fusing into the cellular tissue, very often in the direction of the line of gravity, arrives under the skin, and gives rise to collections which open and give vent to a fluid of a putrid, urinous odor. As the abscess has no tendency to recovery, the single or multiple openings are gradually transformed into urinary fistulæ, which secrete abundantly and often exhaust the patient. Several examples of this kind have been mentioned in the works of the older authors. In Morgagni's[2] case, a hair-pin had produced hypogastric and iliac fistulæ, intense pains, and death. In addition, we find that fistulæ form in the perineum. Finally, the abscess may open, as in the following case, much farther forward at the root of the scrotum.

Observation.—Pen-holder in the bladder.—A young man, twenty-one years old, presented himself with all the symptoms of a stone in the bladder. After incessant difficulties in urination, swelling and inflammation of the genitals occurred, and an abscess formed immediately behind the scrotum, the opening of which became fistulous from the continual passage of the urine. During micturition, he gave utterance to terrible cries, stamped his feet, rested himself on his knees, and remained in this position for hours at a time. A calculus was found engaged in the neck of the bladder. Extreme exhaustion, fever, diarrhœa, œdema of the limbs, face and feet. Bilateral lithotomy was performed; the perineum was very indurated. It was necessary to cut the prostate with a bistoury, as the calculus did not allow free play to the lithotome. A large calculous mass, the size of a pigeon's egg and friable to the touch, was found, but it could only be extracted in pieces. A long, hard, immovable body remained, which could not be withdrawn by forceps. With the right index finger the end of a long metallic wire was slipped under the body, and by its aid a see-saw motion was performed, and a pen-holder was extracted, composed of brown copper, glazed in black, and eight centimetres long. The patient confessed that he had introduced it at the age of fifteen years, during some lewd manipulations. He had endured it for six years without calling attention to it. Recovery.

The spontaneous discharge of a concretion formed around a nucleus, through an abscess opening into the perineum or hypogastrium, has never been observed, except in cases of projectiles; but the conditions are then somewhat different from the ordinary circumstances. This does not happen because nature has no tendency to isolate a body which irritates the organ, but the local disorders are such that the process is usually incompatible with life. In some autopsies the first stage of this process has been observed, and the foreign body has been seen to have partially passed out of the bladder. It is certain that the existence of a columnar bladder and of incomplete accessory cavities somewhat favors this migration. Morgagni has furnished an illustration: a brass hair-pin had already formed a lateral pouch; the remainder of the pin, after having passed through the orifice of the sac, was directed obliquely downward, and its point was embedded in the left side of the fundus of the viscus, so that it was very difficult to perform extraction.

[1] Bull de la Soc. de chir., p. 393, 1878.

[2] Morgagni: De sed., p. 20.

CHAPTER IV.

THE DIAGNOSIS OF FOREIGN BODIES IN THE MALE BLADDER.

THREE questions present themselves to the surgeon when he finds himself in the presence of a patient in whom, according to the history and the collection of the symptoms, there is reason to suspect the existence of a foreign body in the bladder. He must ask himself:

1. If a foreign body is really present.
2. What is its situation and position.
3. What is its nature.

In order to arrive at a solution of these questions, the surgeon must rely upon the history, the subjective signs and the objective signs furnished by an exploration of the genito-urinary organs.

The clinical history varies a great deal according to the origin of the foreign bodies which may have come from without through the natural channels for a therapeutic or lewd purpose, or may have entered the bladder in consequence of an accidental communication with the adjacent organs or with pathological products. In a general way our data decrease in the order which I have indicated, and, while they are explicit when an individual has broken a catheter in the canal, they are, on the contrary, almost entirely wanting in persons who have had a slow and insidious entero-vesical perforation. There are other differences between these various groups, which result in greater or less difficulties in diagnosis. While those patients who are victims of an accident during catheterization immediately seek for aid, those on the contrary who belong to the other two groups do not come until accidents have already developed—some being actuated by false shame, others by ignorance of the kind of affection from which they are suffering.

However this may be, the history is extremely useful in foreign bodies of therapeutic origin, especially if the surgeon can obtain a representation of an instrument similar to that which has been swallowed by the canal, or the piece of the broken catheter which was withdrawn. This is an indispensable preliminary precaution without which treatment is uncertain, because it would be difficult, in the latter case, to determine if the entire portion of the foreign body has been extracted, and if no pieces have been left behind.

The indications furnished by those who, during lewd manipulations, have allowed their instrument to fall into the bladder, are also very important, but unfortunately uncertain.

The data obtained from this source, which should be so useful, are usually inexact, and it is rare that the patients do not seek some subterfuge, that they do not relate some imaginary story, or invent a history of some traumatism or act of malice during sleep. However, despite these uncertainties, this source should not be neglected, for we may derive great benefit from it if we employ tact and sagacity in our conduct toward the patients. Above all, we must inspire them with confidence, and must not forget that the physician, in the exercise of his duties, is no moralist. We should never humiliate these unfortunates or taunt them concerning their ridiculous story. Nor should we endeavor to obtain

their history from them in the presence of witnesses, as they will then rarely respond. We must skilfully interrogate them, and especially appear to believe all their tales, in order to obtain information concerning the nature of the foreign body. These two points alone interest the practitioner. It matters little to determine whether another person has interfered or not, or whether the accident has happened at the moment of an erotic orgasm, as this will not afford the slightest information concerning the length, shape, and regularity of the object. Being reassured concerning the possibility of recovery, full of confidence in the physician, and emboldened by his indulgence and benevolence, the patient very frequently confesses his fault and makes a complete revelation. But affairs do not always terminate so well, and sometimes even the history has been a source of error. Even at the moment in which the operation is performed in order to remove a calculus of whose origin we are ignorant, the patient remains mute and will not admit his wrong until he sees the unmistakable proof of his shameful practices. Furthermore, there are some who deny even when the surgeon shows them the pen-holder or pin, of whose existence they claim entire ignorance. If they are more rational and make the confession before the operation, the surgeon should obtain a similar body, according to the indications of the patient. If the like of such an object, as certain pieces of wood, cannot be obtained, we should make the patient trace the shape and approximate dimensions, etc., on paper. Finally, the history may be very obscure or absent when it refers to foreign bodies which have come from an adjacent organ.

The subjective signs, which are useful in the diagnosis of the foreign body, are very scanty, and in themselves would be insufficient to determine their existence. In fact, the majority of the symptoms which accompany their introduction into the bladder present nothing characteristic, as they are due to the cystitis. At the most, they may awaken attention, and, added to the history, will aid in a more exact determination of the position which the body occupies in the bladder or urethra. If the body has been present for a longer period, the symptoms peculiar to calculi will enable us to affirm its existence, although it is impossible to state whether it has formed around a foreign body or not. Hence, a large number of these patients have for a long time been supposed to suffer from ordinary calculi.

But this is not true of the objective signs which are furnished by external or direct exploration, by means of the introduction of instruments into the bladder. Above all, we must be assured that the foreign body is no longer in the urethra, and, for this purpose, examine the entire length of the canal by external manipulations, the spongy portion of the urethra by palpation, the membranous and prostatic portions by the rectal touch. This point being settled, the introduction of an instrument into the bladder will not present the great annoyance of pushing into its cavity a foreign body supposed to be in this organ, though it was really in the urethra. But, before passing to instrumental exploration, we should be certain that one end of the foreign body is not in the prostate, and this is determined by means of the rectal touch. Modern authors appear to place too little value in this mode of exploration, when it refers to foreign bodies in the bladder, and, according to them, it possesses no real efficacy except in the preceding case, or perhaps when one end of a long and rigid foreign body projects into the rectum by pushing before it the fundus of the bladder.

Direct exploration alone can give accurate data concerning the exis-

tence, situation, position, and, to a certain extent, the nature of the foreign body.

A metallic catheter of somewhat marked curve, like that of Mercier, being introduced according to the ordinary rules into the bladder, will suffice in the majority of cases to furnish some idea of the existence of the foreign body. But this is not by any means easy in all cases, and only a surgeon who is skilled in the use of these instruments can diagnose the presence of a soft body like a shoe-string, a piece of cloth, leather, etc. Rubber bougies and catheters are also very difficult to detect, and it requires the delicate and sensitive touch of the practised physician to distinguish the friction of a foreign body against the catheter from that of the vesical mucous membrane.

This fact being admitted, where should we proceed to search for the foreign body, above or below? The body usually occupies the fundus, as I have previously stated, and will be found in this situation. But if the sound encounters nothing abnormal, it should not be withdrawn without exploring the other parts of the bladder, because foreign bodies have been found floating upon the urine or imbedded in the upper wall.

The sound can only furnish exact data with regard to the existence of the foreign body. The sensation which it communicates to the hand of the explorer will enable him to appreciate, to a certain extent, the hardness of the body, and some slight information concerning its shape, size, and mobility. It is far inferior in this respect to the lithotrite, concerning which I must now speak. These latter instruments, in fact, especially the spoon-shaped and flat-bitted lithotrites, are excellent, and furnish very exact ideas with regard to the position, nature, dimensions, and mobility of the object. When there is reason to suspect the presence of a foreign body in the bladder, it is better to introduce the lithotrite at once, as it fulfils the same purpose as the sound, and is far superior in other respects. Upon seizing the foreign body between the bits, we can determine its dimensions by means of the separation of the blades. If, upon separating them farther and upon impressing some antero-posterior movements on the instrument, we no longer experience the sensation of the foreign body, this is due to the fact that it is movable and has fallen into the fundus. If, on the contrary, it remains, there is reason to believe that it is long and firm, and that its two ends rest against the walls. Some authors have even been able to follow long foreign bodies with the lithotrite, from one end to the other. Finally, the percussion of the body by means of the male blade, continuous pressure, etc., enables us to appreciate the degree of resistance with great exactness. Each datum should be controlled and carefully registered, and it is rare that a well-made exploration does not furnish useful information with regard to the body. If it is resisting, of small diameter, long, and placed transversely in the bladder, the surgeon should suspect a hard body, like a metallic pen-holder. If the body gives a sensation of a dull shock, and resists pressure to a less extent, there are greater chances that the body is made of wood or is analogous to a catheter; the latter, however, will allow itself to be depressed by the instrument. It is impossible to explain in a general treatise the thousand and one peculiarities met with in the search for foreign bodies in the bladder. The preceding remarks will suffice to show that a great deal depends upon the manual skill of the surgeon, and that students cannot be instructed too thoroughly in the management of these instruments.

We must confess that the diagnosis of some bodies is a matter of

pure chance, because the sensation which they impart through the sounds or lithotrites is too feeble to be always detected. In Foucher's case,[1] which referred to a body formed of patent leather, the sound imparted a sensation of friction rather than of shock. Finally, it would be very difficult to determine the nature of a soft body like that referred to in the following observation:

Observation.—Pascal Barseilhac, the nephew of Frère Come, relates that he withdrew from a gentleman's bladder three long, round bodies about the size of an index finger, and which were nothing but mushrooms of the kind known as lycoperdon or paddock-stool. The sound only came in contact with them by chance, and the shock imparted was feeble.

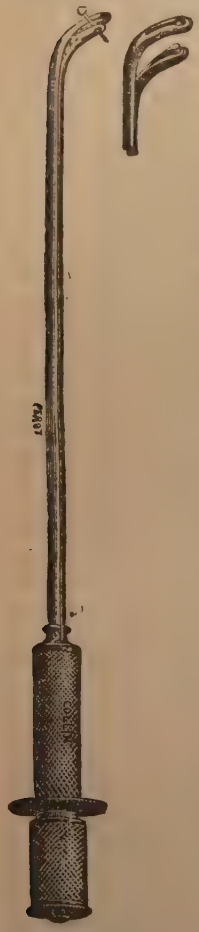

FIG. 57.—Collin's resonant explorer.

Collin, who is continually endeavoring to perfect our surgical arsenal, has recently devised an explorer of extreme sensitiveness and simple construction. He has thus solved one of the most difficult problems of the application of acoustics to surgical exploration. One end of this explorer resembles the two blades of a lithotrite. The male blade carries in its interior a small pedal upon which every body grasped by the lithotrite will rest. This pressure has the effect of establishing a mechanical contact, which is shown by the noise of a small resonator placed in the handle of the instrument. Collin's vesical explorer, which was presented by F. Guyon to the Surgical Society, is extremely sensitive and recommends itself.

Hitherto I have supposed that the body, which had been introduced for a short time, was not covered by concretions. But how much more difficult does the diagnosis become when a nucleated calculus has formed! We can then merely make a retrospective diagnosis, and it is only during the course of the operation that we are enabled, under exceptional circumstances, to recognize the presence of a nucleus. During the operation of lithotomy, the finger introduced into the bladder feels the abnormal points, or perhaps, as is more frequently the case, the inefficiency of the blind tractions attracts attention and enables us to discover the reason of the obstacle in a foreign body eight or ten centimetres long. In rarer cases, the surgeon succeeds in grasping and determining the nature of the foreign body during lithotrity. However, cases of this kind do exist; they demonstrate both the skill of the specialists in diseases of the urinary passages, and the great advantage which may be derived from the use of a well-managed lithotrite. I republish a case observed in the practice of the distinguished Civiale:

Observation.—Locket in the bladder.—Calculus.—Lithotrity.—Extraction.—Recovery.—A man, who was worn out by excesses and pain, had a large stone in the bladder. As the calculus was friable, it was crushed during the first lithotrity sitting, and treatment was then pursued with regularity. At the close, upon searching for the last

[1] Bull. de thér., 1860.

remnants of the stone, a hard body was felt which resisted pressure, and the nature of which Civiale could not at first determine. The earthy layer with which it was covered confused the sensation produced by the contact of the instrument. Its flattened shape and small volume were recognized. Extraction was then attempted, and proved neither difficult nor painful. It proved to be a locket which was nearly six centimetres long and one and a half centimetres wide. This man stated that, having become intoxicated, he fell asleep on the bank of a river at a little distance from a scullery, and that the washerwomen introduced into his bladder the locket which one of them wore! (Bull. de l'Acad. de méd., 1859.)

In conclusion, of all the elements of diagnosis, the history and the data furnished by exploration alone have a real value, and much more attention should be paid to them than to the subjective symptoms.

CHAPTER V.

TREATMENT.

In discussing foreign bodies of the urethra, we have seen that external manipulations of extraction, without direct interference, present some chances of success. But this is not true with regard to the bladder, which is so deeply situated as to be beyond the manual interference of the surgeon. Nor is there, so to speak, any palliative or mild method in the treatment of foreign bodies of the bladder, and we should always resort to the surest and most direct means, whose object is always extraction. However, some attempts have been made to favor spontaneous expulsion by the unaided efforts of the bladder, or to dissolve certain bodies in the organ itself. Despite some successes, these measures only possess an historical interest, and testify to the laudable but fruitless endeavors of surgeons to effect their purpose.

The examples of spontaneous expulsion are very rare; if the surgeon attempts to favor it, he will only succeed by chance, and usually fails. A suitable position at the moment of micturition has sometimes favored the engagement of one end of a narrow and elongated foreign body, and even its expulsion by the stream of urine. According to Servier,[1] Legoust succeeded in causing the expulsion of the handle of a pen-holder from a soldier's bladder, by placing him on his knees and making him support himself on his hands during the emission of urine. The foreign body was expelled at the third or fourth attempt. This plan is inapplicable when the foreign body has been present for some time. It is only useful in the beginning, and furthermore, we cannot prolong the attempt immeasurably, because we lose precious time and run the risk, in temporizing, of setting up a vesical irritation, which is very unfavorable for manipulations of extraction.

The remarks made on spontaneous expulsion and treatment by position will also apply to measures of solution and softening.

During the last century Ledran had formed the idea of injecting mercury into the bladder, in order to attempt to dissolve a piece of leaden

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[1] Servier: Gaz. hebd., 1868.

catheter which had remained there. But his plan does not appear to have had much success, since the body in question was found at the autopsy of the patient in whom it had been employed.

The reader will find the history of this memorable case in Percy's "Manual of Military Surgery." Such attempts have not been repeated, and this measure has fallen into an oblivion which it does not perhaps deserve, as this form of treatment has not been resorted to.

At the present day some surgeons have again resorted to solvents in order to soften soluble foreign bodies, such as sticks of sealing-wax, and Leroy d'Étiolles made, in this respect, a certain number of curious experiments [1] in a case in which a stick of sealing-wax had been introduced by a young man through the urethra into the bladder. He discovered that the fixed oils (naphtha) were too irritating; that the essential oils (turpentine, mint, absinthe) are too slow compared with the time during which their contact may be tolerated by the bladder. He found that it would require more than twenty-four hours in order to dissolve a piece of wax. Leroy then tried pure alcohol and succeeded in two hours; but its mixture with the urine, by diluting it, would render its action much slower, and, in addition, it would be imprudent to inject such a concentrated fluid.

Leroy confined himself to the use of warm-water injections at a temperature of 37°–40° C., which in one hour succeeded in softening a stick of wax in such a manner as to render it malleable. He then made four seances of warm-water injections into the bladder and removed the entire foreign body in pieces; the latter measured nine and a half centimetres in length. Nélaton was also successful in dissolving a similar body with oil of naphtha.

Observation.—Stick of wax in the bladder.—Solution by oil of naphtha.—Nélaton had under his care, at Saint Antoine, an old furniture-maker, who had introduced into the penis, and then into the bladder, a long cylinder of wax used for waxing floors. The foreign body, being of soft consistence, could not be seized by the spoon-shaped stone-crusher. The greatly irritated bladder contained no urine, and did not long tolerate the water which was injected into it, so that the explorer was very much embarrassed, not knowing whether he grasped the wax or the tissue of the bladder. Nélaton then asked the advice of the chemist Dumas, and began to attempt to act upon the foreign body with the aid of a solvent, viz., the oil of naphtha. The intolerance of the bladder rendered the injections of this fluid almost useless, but, with perseverance, a certain quantity was retained every day, and, under the influence of this treatment, which was continued for fifteen days, the symptoms due to the presence of the foreign body entirely disappeared, so that there was every reason to believe that solution had occurred.

However, these are merely ingenious, but exceptional methods, which are inexact, and are not really susceptible of practical application.

Extraction.—Two great methods enable us to fulfil the indications for treatment of foreign bodies in the bladder, viz., first, extraction through the natural passages; second, extraction through artificial passages. These are not of equal date: the first, which originated in France in the first half of this century, became more general as instruments were perfected and as surgeons became familiar with the use of the lithotrite. On the contrary, artificial extraction by means of lithotomy, which was formerly alone employed, tends to-day to be restricted to a certain number of cases, in which it is absolutely indicated in the absence of any other plan.

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[1] Leroy d'Étiolles: Union médicale, 1869, p. 509.

The authors who have written on the treatment of foreign bodies of the bladder have taken their physical properties as the basis of their division, and have imitated Civiale in this respect, who admits three varieties:

1. Soft or friable ovoid bodies.
2. Long, soft, flexible bodies which bend.
3. Long, rigid, inflexible bodies, which can only be extracted in the direction of their length.

Denucé criticises Civiale's classification, because it places very hard or very soft, very fragile or very flexible bodies, in the same category. Reliquet[1] divides them into four groups: the first includes rounded or oblong foreign bodies, which can be crushed, broken, or cut; the second, oblong, flexible bodies which can be bent or cut; in the third class he places long, rigid foreign bodies which can be cut or broken; and, in the fourth, long and rigid bodies which cannot be cut or broken.

After mature deliberation, I have come to the conclusion that we should not, in the treatment of foreign bodies, adopt this point of view, which is based on the special properties of the object, and I think that we can better explain the various measures of each method, by calling attention to the indications which they fulfil. In this manner the treatment is less exclusive, and the substances, which enter into several categories at the same time, may be extracted by various measures, the choice of which is left to the judgment of the surgeon.

1. Extraction through the Natural Channels.—This method includes a certain number of measures, which nevertheless have common characteristics. All, in fact, act upon the foreign body by means of instruments of a very large calibre, and they consequently demand preparation of the canal. We must therefore, by preliminary manipulations, put the canal in a condition which will enable it to tolerate the passage of the instruments and facilitate their action in the bladder by means of suitable injections.

Preparatory manipulations.—The preliminary dilatation of the urethral canal is one of the most indispensable precautions, and sometimes presents itself very urgently, when the canal is abnormal, as happens in individuals who have pieces of catheters or bougies in the bladder. Many of them were treated for stricture of the canal, so that the difficulty of relieving the accident is greatly increased by the necessity of making a preliminary dilatation. Whatever may be the reason, we must, above all, take the condition of the canal into account, and we must employ a bougie à boule or a conical bougie. After having previously determined its dilatability, we gradually accustom it to the passage of larger instruments with a great curvature, which should be manipulated in the bladder. But it is not necessary in the normal urethra to pass beyond a diameter of 9 or 10 mm. At a later period I will show the dangers and inconveniences which result from a neglect of these rules. The dilatation is even less, if the urethra has been diseased for a long time, or if the sound, in order to arrive in the bladder, must pass through a hypertrophied, irritable prostate which does not readily lend itself to the passage of lithotrite instruments. In such a case it is not prudent to endeavor, as is sometimes done, to force the primary lesion to an unwarrantable extent, or to pass through it at any cost, because there is danger of

[1] Traité des operations sur les voies urinaires.

producing serious accidents. Extraction, which is a serious matter in itself, then becomes a truly dangerous operation.

Civale has performed dilatation of a stricture before extracting a piece of catheter from the bladder, but it had not been thoroughly done, and, upon withdrawing the instrument and the foreign body, the latter again broke in the region of the stricture. Strictly speaking, we can apply to the male urethra the three measures which are frequently and efficiently used in the female urethra. These are: 1, slow and progressive dilatation by means of a variety of sounds; 2, continuous dilatation by means of catgut bougies, etc., which are left in the urethra; 3, finally, sudden or forced dilatation by means of dilating or divulsing instruments.

The preparation of the bladder generally consists in the preliminary injecting of a certain quantity of fluids, usually water, for the purpose of filling it and preventing wounds of the walls during the manipulations of the instruments, and of shielding them from the contractions which, being much more active when the foreign body is in contact with the walls, almost entirely prevent the play of the forceps and lithotrites. Some surgeons have conceived the idea of injecting other substances than water, either in accordance with their own views or to favor prehension in special cases. Thus Cazenave, of Bordeaux, advised the introduction of thick, mucilaginous fluids, which surround the foreign body and render it somewhat immovable. Others have injected oil in order to lubricate the walls of the bladder and favor the passage during extraction. I will only refer, as a matter of curiosity, to the plan proposed by Ségalas, and which he employed: it consisted in the simultaneous or successive injection of a certain quantity of air and water for the purpose of allowing the foreign body, which he was seeking, to float. Numerous fruitless attempts had been made to discover a piece of catheter three inches long, which had become the nucleus of a calculus and was entirely incrusted when withdrawn; this surgeon then conceived the idea of making injections of air and water. This is merely a curious and exceptional measure, which we should imitate only after exercising great caution, and we must remember that the introduction of air into the bladder has not been proven to be innocuous.

Division.—The method of extraction through the natural channels includes measures which may be ranged in two groups, according as the foreign body is extracted entire, or is removed in pieces. I will pass them in review in succession.

1. Measures by which the Foreign Body is removed intact.—All the instruments which are at the disposal of surgeons in effecting this object belong to one of the three following classes:

1. Simple prehensors.
2. Redressors or pliers.
3. Duplicators.

1. *Simple prehensors.*—The object of these is to seize the foreign body at one end, and to extract it by withdrawing it in the direction of its long axis. Prehension at a little distance from the ends is an indispensable condition if the body is long, but this evidently does not hold good if it is ovoid without any predominant diameter.

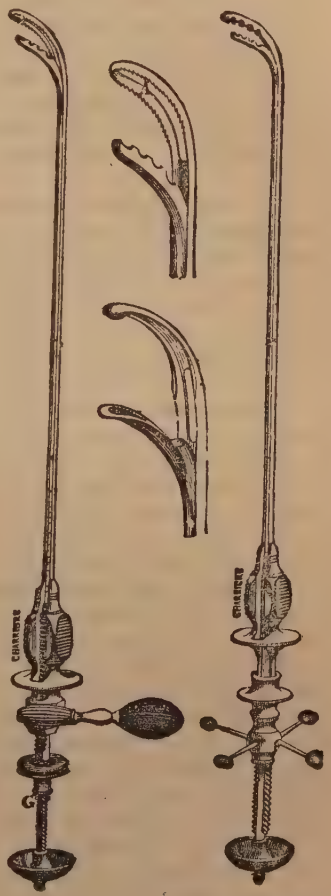
The number of prehensors is very large; many of them, in consequence of successive improvements, have disappeared, so that it would be idle to enter into special descriptions of antiquated instruments. Even the an-

cients possessed some instruments which enabled them to extract foreign bodies from the bladder through the natural passages. Resort was at first had to metallic hooks, which presented no precision, acted at haphazard, but sometimes succeeded in extracting long bodies, especially when they presented by a bent end, which could be retained by the hook. Morgagni has left us an illustration of the fortunate results obtained by an instrument known as Volpi's hook, from the name of the surgeon "who used a highly polished iron wire, which he curved at one end in the form of a small, almost angular hook, in such a manner that he could seize the needle without wounding the bladder, and, when the latter was once engaged, its small head prevented its escape."

I will only mention, in passing, Loiseau's hook and the accidental successes obtained with the eye of a metallic catheter, in which a long foreign body of small volume became engaged by chance. Leroy d'Étiolles was fortunate enough to extract in this manner a piece of a stone-crusher, which had been left in the bladder of a child six years old.[1] This case is not unique, but such exceptions cannot serve as a basis for serious treatment.

A second group of instruments comprises all spring-forceps, from Hunter's bent forceps, which were adapted by Desault to foreign bodies of the bladder, and the metallic hooks sliding in a canula (Gruithuisen, J. Cloquet, Jacobson, Leroy's prostatic ligature tightener) to the more perfect instruments of Civiale and Ashmead.

Marianus Sanctus had devised a long forceps with very narrow and long hinges, which was manipulated by a lateral screw. A. Cooper employed a similar instrument. Franco and Ferry's forceps formed a transition between the preceding ones and Desault's spring-forceps. Civiale's trilabe is undoubtedly one of the most perfect instruments of this kind. It is composed of an external canula, a spring-forceps with three blades placed in its interior, and finally of a central mandrel, which serves, when pushed in one direction, to secure prehension, and in the other direction to increase the separation of the blades. Of all the old instruments this is undoubtedly the one which has rendered the greatest services. It has been modified a thousand times, especially in the arrangement of the bits of the forceps. If we desire to form an idea of the ingenuity of surgeons, we should read,



FIGS. 58 and 59.—Models of lithotrites for the extraction of foreign bodies of the bladder.

[1] Leroy d'Étiolles: Recueil de lettres et mémoires, 1844.

in the special treatises, the various modifications of this department of the surgical armamentarium. Ashmead has even gone so far as to establish a movement of opposition between one of the blades and the three others in such a manner as to simulate a hand. Dose succeeded in removing a bean from the bladder with the aid of a form of Desault's ligature-bearer, which was bifurcated and terminated in two half-rings.[1]

But much greater interest attaches to the class of sliding forceps, the primitive type of which is found in A. Paré's[1] legendary "*parrot's beak*," and the most perfect type of which is represented by Heurteloup's and Charriere's lithotrites, etc. We must also add that the combination of hinge and sliding forceps, which is realized in the forceps with interrupted lever, gives to modern instruments a superiority which explains the brevity with which I have spoken of the older instruments. All these forceps, whatever their name, are composed of two parts, which glide in one another with gentle friction along a groove. The inner blade bears the name of male blade, in contradistinction to the external or female blade.

The ends have undergone a large number of modifications, according to necessity, the special case, etc. Sometimes the scoops are straight, but they are usually curved, and either full or fenestrated; some are flat, others are deep; some prefer bits, others prefer simple grooves. Finally, the modifications also refer to the relative width of the scoops, in order to avoid grasping the mucous membrane, and also to the other end of the instrument, which may be graduated, furnished with a percussor, a fixation apparatus, etc.

Heurteloup's percussor is still the most generally employed prehensor in the extraction of foreign bodies, especially the smaller forms, which may be used in children. A male blade glides in the groove of a female blade; both of them terminate in a curved scoop, and fit together in such a manner as to give the instrument the appearance of an ordinary sound. The movement of the blades upon one another is secured by means of two pieces which are found at the other end.

Another modification has rendered some service: it consists in causing the scoop of the female blade to be traversed by the male blade, which can move in this manner, although the former does not lose its immobility.

Before employing prehensors, the patient is placed in a suitable position, as if for ordinary lithotrity: lying upon the back, the head slightly elevated, the thighs semi-flexed and separated, care being taken to relax all the muscles. Anæsthesia is useful if the patient is excitable and very sensitive, and if, through fear or any other cause, he interferes with the preliminary manipulations. But patients whose resistance or susceptibility is known often tolerate attempts at extraction very well, thanks to the preparatory manipulations.

1. *Prehension of an ovoid body of small size.*—Whatever instrument may be employed, it is introduced in the usual manner after having been previously oiled. It is made to enter the bladder while closed. When it has reached it, we must proceed to search for the foreign body, and for this purpose employ the indications furnished by previous explorations, and incline the instrument in one direction or the other, according to the part with which the body is in contact. The body is encountered usually in the fundus of the bladder, *i. e.*, inferiorly and posteriorly. The contact is not always a well-defined shock, as in a case of calculus or hard

[1] Gaz. méd., 1833, p. 642.

body. But if anything is detected, the operator opens the instrument by rendering the male blade immovable, pushing the female blade forward, and slightly lowering the end of the instrument. If the body is movable, it will fall spontaneously into the concavity of the female blade. The prehensor is closed by pushing the male blade until it meets the other one, which is held fixed. This is the classical manipulation. The foreign body may remain underneath the instrument, in which event the forceps should be inclined to one side; the same result is obtained by causing the position of the patient to change, and by turning him a little to one side, or by Guyon's indirect manipulation. When the body has been seized, the lithotrite is gently withdrawn, if the separation of the blades does not exceed 9 or 10 millimetres. In the opposite event, we must abandon these

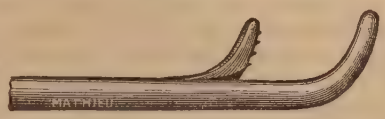


Fig. 60.—Beak of the lithotrite for the extraction of foreign bodies of the bladder.

Fig. 61.—Small lithotrite for the extraction of foreign bodies of the bladder.

attempts and resort to other measures. Moreover, this manipulation does not differ from prehension with the ordinary lithotrite, and I refer the reader to the special treatises on the subject.

The foreign body is elongated.—Affairs run a very different course when the body is elongated, soft, flexible, rigid, etc. In such cases we

Fig. 62.—Guyon's stone-crusher, very useful for the extraction of foreign bodies of the bladder (Collin's model).

should seize the foreign body at one end, in order to place it in the axis of the canal. This will only be the result of chance, in all soft foreign bodies, if we use a forceps, litholabe, or flat-bitted lithotrite. As there is nothing to indicate to the operator whether the instrument seizes one end of a catheter or its middle, he can only act blindly. This is not true with regard to rigid bodies, especially since the careful observations made by Caudemont[1] upon the inclination of the lithotrite when traction is made after prehension. This observer has arrived empirically at certain conclusions, which are admitted by modern authors. All the operative manipulations which he advises are based upon the following principle: if, after having seized the foreign body, traction is made upon the instrument, the latter undergoes a lateral inclination, and the groove of the female blade is always found on the shortest side of the foreign body. If the latter is grasped in the middle, the instrument remains straight; but if it is seized near one end, the hand which holds it will experience, on withdrawing it, a greater resistance on one side than on the other, and the lithotrite will incline to the side of the shortest portion. A knowledge of

[1] Soc. anatomique, 1848, p. 343.

this fact is extremely useful, because a very slight and simple manipulation will then suffice to slide the instrument along to one end. In order to do this the male blade is withdrawn a little without removing the female blade upon which the rod rests. The lithotrite is then inclined toward the nearest end of the body; the male blade is pushed in and again grasps the foreign body. If the latter is seized at one end, as soon as traction is made, a rotatory movement of the body around its long axis is produced on withdrawing the blade of the instrument, thus straightening the object and carrying it into the axis of the canal.

The indications which are fulfilled.—The prehensile instruments are very useful whenever the body to be withdrawn from the bladder is small, regular and ovoid, like a bean. In the same way they have an undeniable value in the extraction of long, rigid foreign bodies (sticks of wood, metal, ivory, etc., metallic catheters), but only if they are movable in the bladder. In the opposite case it is better to resort to more certain measures. Apart from these indications, prehensile instruments have no other utility, and may even become dangerous if we persist in employing them. In order to withdraw rigid bodies with them, we should always make use of Caudemont's manipulation. This method has recently suc-

Fig. 63.—Beak of the lithotrite for the extraction of elongated objects.

ceeded very well in the hands of Delefosse, one of his pupils. He was able, with a simple flat-bitted lithotrite, to extract an iron carriage-pin nine centimetres long, from a coachman's bladder. He was only successful after half an hour's patient labor.[1]

If the physician is not familiar with this manipulation, it will be well to substitute a trilabe or a straight forceps with a percussor or stone-crusher. In fact, as Civiale had already established, we run much less risk of injuring the parts with the trilabe than with the percussor, the blades of which seize the body transversely, while the first acts directly. A large number of foreign bodies have been extracted with the trilabe, and if we possess no other instrument, it may fulfil nearly all the indications. At the present time the stone-crushers are very much in vogue,

[1] Revue de thérapeutique médico-chirurgicale, p. 482, 1878.

and their popularity has rendered the manipulation much more familiar, so that, in the absence of redressors, duplicators, etc., a skilful hand will always know how to carry on the attempted extraction to a successful termination.

2. *Redressors or "basculeurs."*—Many instruments, to which the term redressor or plier has been applied, have been devised for the purpose of extracting foreign bodies from the bladder. All act in the same manner, by carrying into their own axis the body which has been seized between the teeth of the forceps or the blades of the lithotrite. There are a considerable number of these instruments at the present time. Leroy d'Étiolles, to whom the credit of having devised this form of extraction undoubtedly belongs, has constructed no less than five of these instruments, among others the cap-forceps, the rack and pinion stone-crusher. The latter is merely a double-bladed bilabe, with two small racks which are movable by means of narrow wires, prolonged as far as the handle of the instrument. It enables foreign bodies to be seized, to be moved up and down, and to be dropped into the double furrow in which they are completely enclosed.[1]

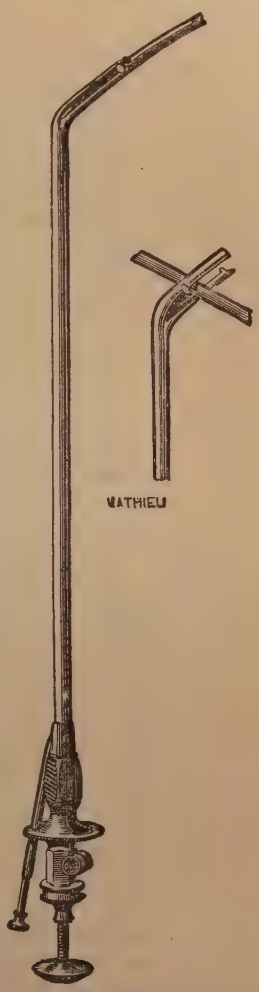


FIG. 64.—Redressor of Leroy d'Étiolles.

1. *Leroy d'Étiolles' redressor.*—It is composed of an ordinary lithotrite, to which a very ingenious see-saw system is adapted, which is readily understood if not manipulated. For this purpose, a point of arrest is situated near the end of the male blade, which projects from the instrument externally and forms a notch with it when the two blades are closed. A small *curseur* situated on the female blade is put in motion by means of a wire communicating with a special part of the handle. If the external button is pushed, the *curseur* slides along to the end ; if, on the contrary, it is withdrawn, the *curseur* moves to the situation of the bend. In order to use this apparatus we first seize the body in the ordinary way, care being taken to pull previously upon the button in order to place the *curseur* in the bend. The foreign body being usually seized transversely, the button is pushed upon, and the *curseur* carries the object before it until, having arrived at the end of the instrument, it comes in contact with the point of arrest of the male blade and revolves around it, thus placing itself in the axis of the instrument.

But the portion which is thus brought in contact with the instrument must not be longer than the elbow of the latter, and in order to effect this we must grope around somewhat, or use Caudemont's method, or perhaps even make the instrument slide upon the foreign body, resting with

[1] Gaz. méd., 1851, p. 122.

one end against the walls of the bladder. This ingenious redressor is not very easily manipulated, and the most serious objection that can be made against it is that it is unpractical.

Robert and Collin's redressor.—The principle of this instrument depends almost entirely on the arrangement of the blades. It has retained the shape of an ordinary lithotrite, but the handle contains a thumb-screw for the purpose of fixing the blades at will. I reproduce from Reliquet[1] the description of the bit of the instrument: "the female blade is very large, with a posterior surface and rectangular back, presenting on one side a projecting edge which encroaches upon the stem, very high at the elbow and then diminishing more and more up to the end of the blade, where it no longer projects. The straight and smooth edge of this surface is very much inclined in the direction of the stem of the instrument. The other grooved surface of the female blade has a sudden projection almost to the end of the blade. The male blade, narrower than the female, has a rectangular back like the latter. One side, corresponding to the inclined surface of the female blade, presents a triangular surface, the base of which is below and the apex above. The free edge of this lateral surface, as we approach the two teeth, glides along the inner surface of the inclined edge of the female blade, pushing before it the foreign body, which is placed between the teeth at the end of the beak of the instrument. The male blade presents no projection on the other side. This side also, on approaching the grooved female surface, when it reaches the inner surface of the projection at the tip of the female blade, limits a rectangular opening anteriorly, which is completed behind by the surface of the elbow of the female blade."

When the foreign body is grasped, it is revolved in a plane inclined to the perpendicular, on the one hand carried toward the end of the scoop, on the other grasped in the groove formed by the union of the two blades. Upon withdrawing the instrument, after having revolved it toward the neck of the bladder, we must assure ourselves that it is well in the axis. If this is not so, it has been seized too far from the end, and we must bring it nearer, either by sliding the blades upon the foreign body which rests against the wall, or by Caudemont's method.

Mathieu's basculeur.—This instrument differs markedly from the preceding ones. It is formed of a canula terminating in a spout at the vesical extremity. A hook, in the form of a half-ring, slides along the interior and completes the canula in its grooved portion. The instrument is introduced, while closed, into the bladder, and the hook is pushed beyond the end in order to seize the foreign body. Upon withdrawing it, it forces the body against the end of the canula, makes it revolve, and lodge within the groove. The instrument is then withdrawn. A cock placed in the handle enables us to make an injection into the bladder without removing the instrument.

All these instruments are useful and prove serviceable on occasion, but they are only applicable to a very limited number of cases. The foreign body must be long, rigid, inflexible, and of a small diameter. They are useless or uncertain for catheters, bougies, twine, etc. Thompson is opposed to these redressors because they are not efficient unless they seize the foreign body at a short distance from one end, and because they require, in extraction, the same manipulations as the ordinary lithotrite; he therefore considers them useless. There is undoubtedly some truth in this

[1] Traité des opérations des voies urinaires, p. 667.

opinion, and if we add that instruments so little used require great skill, we will understand how much more preferable it is to use a simple lithotrite. Collin has endeavored, by new modifications, to fulfil the desideratum referred to by Thompson.

Collin's basculeur.—This instrument, which is of very recent date, has proved an improvement on other models of this class. Like them, it carries the foreign body into its axis by means of beveled blades; further-

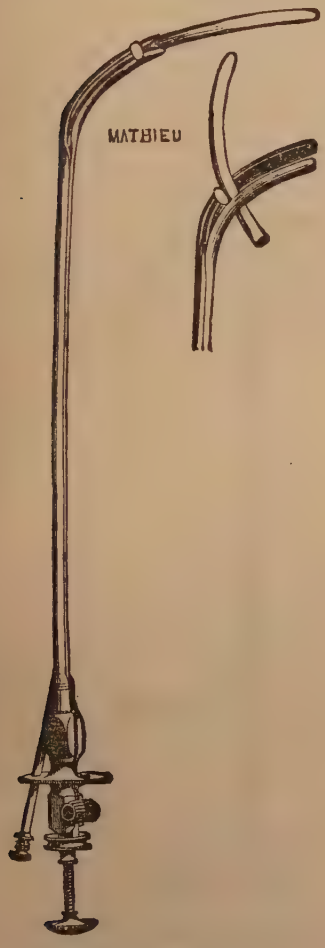


FIG. 65.—Mathieu's basculeur.

FIG. 66.—Collin's redressor for foreign bodies of the bladder.

more, the addition of a lower wire enables us to push it forward until it no longer projects under the elbow, and it is seized at one end while in the latter position. In a word, this instrument effects Caudemont's manipulation spontaneously and mechanically. The reader can appreciate its mechanism and manipulations by glancing at the figures representing it (Fig. 66). Time alone will determine its practical value.

3. *Duplicators.*—The duplicators are used to bend the foreign body and extract it in this position. Their effect is to transform the mode of prehension, for, after it is bent, the body which had been previously seized crosswise is directed along the long axis after the duplicature. They are only applicable to two classes of foreign bodies: 1, those which are soft and flexible, like catheters, vegetable stalks, leather thongs; 2, those which are hard, but can be bent without breaking, like brass wire, hairpins, ordinary pins. They are contraindicated, on the contrary, when the

FIG. 67.—Courty's duplicator. (Collin's model.)

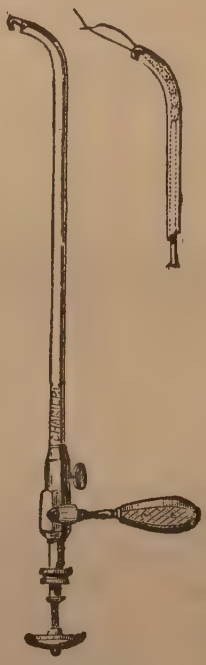


FIG. 68.—Duplicator. (Charrière model.)

body is hard or soft, but, at the same time, friable and inflexible, like straw, pieces of wood, steel pins or needles, pieces of ivory, glass, etc.

All the duplicators devised up to the present time belong to two different types: the first and simplest is represented by the ordinary lithotrite, the female blade of which is somewhat excavated. When the foreign body is seized and pressed with force, the two extremities bend, approach one another, and rise toward the summit of the bladder. With the instrument arranged in such a manner that the male blade replaces the female, the bent foreign body is directed downward. The other type is somewhat different, but much more generally used. A forceps, a cog

or a hook, seizes the object, and withdraws it until it comes in contact with two points of lateral support, against which it is bent. We will now see how authors have realized the last type. The first form of these duplicators was conceived by Leroy d'Étiolles, in 1825, and put into practice by Ségalas in 1832. Since that time, numerous modifications of detail have been made by Branchetti (1835), Spessa, Busi, Betty, Courty, Mercier, etc. Of all these instruments, two alone deserve to remain in use. These are Courty's duplicator, which produces the arrangement of those of Ségalas, Branchetti, etc., with the addition of a magnetic wire, and Mercier's duplicator.

Courty's duplicator.—When closed it very much resembles a rack and pinion lithotrite, the blades of which have been cut ; the female wire terminates in a very bold projection ; the male blade, which is moved by the pinion, presents a strong hook at the end. The manipulation of the instrument is extremely simple. It is introduced into the bladder and an attempt is then made to seize the foreign body, which is applied transversely against the end of the tube, into which it penetrates in proportion as the pinion is moved. In another modification, Courty's instrument has the shape of a small lithotrite ; the male blade traverses the female, which serves as a hook, and the prehension of the foreign body is performed much more readily.[1]

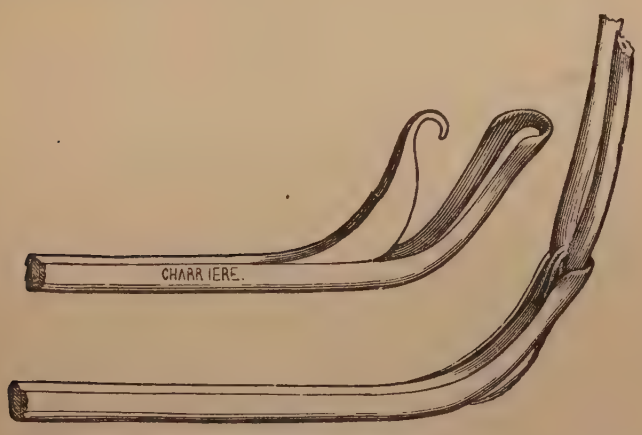


Fig. 69.—Mercier's duplicator.

This instrument is only useful for foreign bodies of small diameter, like pins and needles, but it would be entirely insufficient for firm and flexible bodies like catheters.

Mercier's duplicator.—This belongs to the first type, and resembles a lithotrite in the general shape ; it differs from it only in the arrangement of the blades. The female blade is pierced and its edges are very prominent ; the male scoop, which is hook-shaped at the lower concavity, terminates at the angle of junction with the shank of the instrument, in a rounded projection. If a soft and flexible foreign body like a catheter is seized between the two blades and the male bladder is pushed on until it meets the other, the foreign body, being pushed back by the "pigeon's

[1] Courty : Arch. de médecine, Feb., 1851.

beak" of the male blade, slides along as far as the hook, where it is fixed against the female blade. The instrument is withdrawn at the same time, and the foreign body is bent. The fenestra of the female blade is intended to permit the convex portion of the male blade to become engaged in it.

From the preceding remarks it is evident that each of these instruments has its special indications, one being reserved exclusively for long, flexible and hard foreign bodies, the other, for those which are supple. Experience has shown that Mercier's instrument is very useful in practice, and that it is preferable to all other instruments of this kind in cases of catheters. Mercier has called attention to the fact that duplicators, before being used, should always be tried upon a body of a similar nature to that which is to be extracted. Otherwise, we run the risk of breaking it without attaining our object.

2. Measures by which the Foreign Body is removed in pieces.—Side by side with the numerous preceding measures, must be placed those whose object it is to extract the foreign body after having broken it in pieces. If it is friable, like a calculous concretion, it should be crushed; if, on the contrary, it presents a certain resistance, like a piece of wood, it should be cut into pieces which can be much more readily extracted with ordinary prehensile instruments, or perhaps they will be passed spontaneously through the urethral canal, like the fine gravel after lithotrity. Even when the foreign body is not divided, the crushing of a concretion around it, when readily performed, is always a useful manipulation, because it permits the disengagement of the foreign body itself, and renders its extraction through the natural channels possible.

If the foreign body is surrounded by a concretion, we should employ one of the ordinary lithotrites, and there is no necessity of resorting to a special instrument. But if the body itself is to be divided, we must necessarily employ instruments which are suitably constructed, not for crushing, but for breaking. The first forceps of this kind were devised by Leroy d'Étiolles and Civiale; they bear the name of cutting litholabes. With the exception of a few slight modifications of detail, they are composed of a simple litholabe, the male blade of which, instead of presenting in its curved portion a lower indented border, presents a surface with two lateral edges separated by a groove; the instrument divides the object into three pieces. These instruments, which are still very useful, have been slightly modified with regard to their arrangement, and very strong knife-bearing lithotrites have been constructed. These include, among others, Caudemont's shears. As in all these knife-bearers, the female blade presents a large fenestra without teeth on its edges. The bevelled male blade adapts itself, when the instrument is closed, to another bevel on the female blade, in such a manner as to form a strong shears or cutting apparatus. The manipulation comprises two periods: in the first, the foreign body is seized as in every mode of extraction; in the second, the blades are closed and the object is cut. But, while one piece falls into the bladder, the other fragment remains between the blades. We may extract it immediately if it is not too hard and is properly placed; the operator may repeat the operation a certain number of times.

This method is not applicable to all foreign bodies, because there is danger in breaking cutting or pointed bodies like needles or glass tubes. There are, also, a certain number which, like leather and cloth, would not yield readily to these attempts. We must then restrict the division of

foreign bodies, apart from the crushing of concretions, to long bodies which cannot be easily extracted by grasping one end, like a piece of wood which does not bend, or to objects which, like certain catheters when once folded, could not possibly traverse the urethra on account of their diameter. But we must not form any exaggerated notions concerning the value of this measure. When we are compelled to resort to fragmentation, a long time is necessary before the bladder can be en-

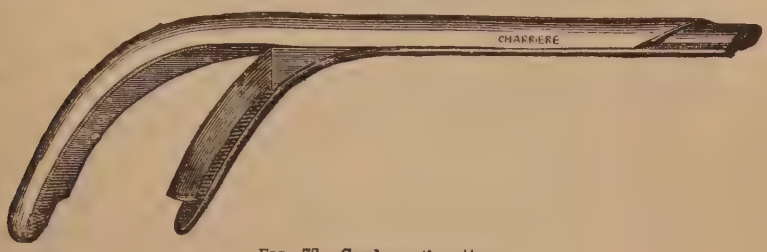


Fig. 70.—Caudemont's cutter.

tirely emptied. Nevertheless, authentic examples prove that expulsion has been obtained. Thus, Birkett[1] relates that he had under his care a man who had a bougie in the bladder; he introduced a lithotrite and succeeded in cutting the bougie into pieces, which were passed with the urine; recovery. Chaumel also succeeded in cutting up a vine-stalk contained in the bladder of a vine-dresser. This man died, but he had already passed several pieces, and the patient had succeeded in removing one with the aid of a loop of twisted horse-hair which he introduced into the urethra for this purpose.

2. Extraction through Artificial Channels.—Lithotomy.—I have previously stated that lithotomy was almost the only method of treatment for foreign bodies of the bladder prior to the employment of various extractors. Since 1850 it is merely a method of necessity, and is only performed when the other methods of extraction through the natural channels have failed or are absolutely contraindicated. When the foreign body has been left in the bladder for a long time, when it is covered with thick and hard calcareous concretions, especially if we know that the nucleus is a metallic body like a pen-holder, we must, from the very beginning, discard simple extraction and resort to lithotomy.

In fact, the manipulations necessary in crushing the concretions in these cases are very dangerous to the walls of the bladder, so much the more as they require a certain amount of force, and because there is nothing to inform us concerning the mischief committed by the points of a fusiform calculus. In the same way, if the bladder is in a poor condition, if the kidneys themselves have begun to experience the effects of the lesions of the lower urinary organs, lithotomy is also indicated. Finally, some foreign bodies may be extracted, according to circumstances, through one or the other channel. I will soon have occasion to revert to the comparative advantages and disadvantages of both methods.

Lithotomy being decided upon, which form should be employed in preference? Two cases must be taken into consideration: one in which the foreign body has been in the bladder for a short while, and the other, in which

[1] Holmes: A System of Surgery, 1861, T. II.

it has become the centre of a large calculus. In the first case it will not be necessary to make large urethral and prostatic incisions, because we can readily search for the foreign body by means of special instruments; in the second case, on the contrary, extraction is very difficult, especially when a foreign body is situated across the neck of the bladder, forms there an insurmountable obstacle, or gives rise to serious disturbances.

For recent foreign bodies we may employ the median operation as practised by Marianus Sanctus: then, after cutting the integument and opening the canal, according to the ordinary rules, we may advantageously apply dilatation according to Dolbeau's plan, which will give the forceps, hooks, vesical forceps, basculeurs, redressors, etc., sufficient room to enable them to act. In England considerable use is made of Allarton's method, which is a modification of the median operation of Marianus Sanctus. Porter makes the cutaneous incision by transfixion from behind forward.

On the contrary, if the foreign body is very irregular or large, the surgeon will, in preference, employ methods which give him much more room, such as the lateral and prerectal operations, and will make long incisions into the prostate along two of its lateral or oblique diameters. Dolbeau performed medio-bilateral lithotomy in order to extract a foreign body, which, having become converted into a calculus, measured more than three centimetres.[1] The incision of the prostate, in cases of large calculi, some of whose irregularities have become embedded, sometimes presents great difficulties, because the lithotome cannot be introduced, or because we are unable to open it after its introduction. This happened to Fleury of Clermont, in a case in which the bladder contained an incrusted shoemaker's awl.[2] In such cases it is wise to determine to slit up the prostate with a long probe-pointed bistoury. Després [3] has proposed to resort to rectal lithotomy in order to extract the foreign bodies by cutting down upon the body when it projects; but this is a "button-hole" operation, and not lithotomy. If we perform ordinary lithotomy, we must incise the urethra below the prostate, and we do not, therefore, see the advantages of this rectal lithotomy, or even of recto-vesical lithotomy, which will often involve the vesiculæ seminales and peritoneum. As Tillaux has justly remarked, there is danger in resorting to such a measure.

The operation itself only constitutes a first stage, which should always be followed by a second, viz., extraction. After opening the artificial passage, extraction presents great analogy with that performed upon the female bladder through the urethral canal. The same measures and instruments are useful. If the foreign body is small and ovoid, like a bean or pit, small hooks, or straight or curved forceps, will prove sufficient. We can also employ the basculeur, redressors, Mathieu's forceps, and that of Leroy d'Étiolles. These are introduced into the bladder upon the finger or a director. Reliquet's instrument is very useful for pins.

The great point consists in not wounding the walls during the manipulations, and in knowing how to appreciate the movements impressed upon the instrument. Rectal touch has sometimes proven useful, and has secured the seizure of a foreign body which escaped the forceps. It would be an error to believe, as some authors have remarked, that the extraction is always performed with facility. Skilful operators have failed even for several days, especially when the body was soft and did not

[1] France médicale, June 27, 1874. [2] Société de chirurgie, 1878. [3] Idem.

transmit a sensation of well-defined contact. Thus, Jurine was compelled to seize a bougie in the bladder twice, and even then he did not succeed until seventeen days after the operation of lithotomy, and with the aid of a new incision. We must exercise patience, change the position of the patient, and not introduce the finger unless we cannot succeed in any other way, in order to avoid the lacerations and ruptures which are inevitable after such an introduction.

If the body is large, in consequence of the concretions, and its extraction is distressing, we should, before withdrawal, endeavor to divide it by means of ordinary or special extractors. If we think that the dimensions of the pieces are compatible with the artificial opening in the prostate and in the canal, we can extract, in succession, the concretions and the foreign body, care being taken to seize it, as far as possible, near one end and along its long axis. If necessary, and when the flexible body permits it, we may perform extraction after bending the object, while a similar manipulation would be very dangerous in the case of a hair-pin or needle. I will not dwell upon the dressing and the conduct to be pursued after the operation, because it does not differ in any respect from the ordinary treatment after lithotomy.

Parallel between the Extraction of Foreign Bodies through the Natural Channels and Lithotomy.

The invention of the instruments described above, thanks to the fertile imagination of Civiale, Leroy, Ségalas, Heurteloup, etc., has produced a complete revolution in the treatment of foreign bodies of the bladder, to such an extent that, according to statistics, the operation of lithotomy has fallen into almost complete discredit. From the very careful analysis made by Denucé, it follows that, among 249 cases of foreign bodies which had necessitated lithotomy or extraction prior to the year 1830, there were 100 cases of lithotomy and 27 of extraction, while there were only 21 lithotomies among 122 cases collected since 1830. The new analyses which I have made since 1856 (the period in which Denucé's work appeared) verify in a general way the results arrived at by this learned surgeon; but they appear to demonstrate that lithotomy is somewhat more frequent than he indicated. Even in the beginning, extraction through the natural channels permitted the performance of some very brilliant cures; and in order to convince ourselves of this fact, it is sufficient to read the minutes of the Academy of Medicine (1841), in which Civiale, Ségalas, and Leroy, the ardent promoters of this movement, related the brilliant results of their practice. At the present time the results are no less satisfactory in the hands of their successors, and not a year passes that periodical literature does not record some success due to the employment of this method.

Nevertheless, despite these advantages, it is open to a certain number of objections, responsible for accidents which are sometimes fatal, and it is far from being a measure whose exclusive employment will replace lithotomy. We must not conceal the fact that all manipulations performed in the bladder are dangerous, and that they become so much more so when the rigid, irregular, and pointed foreign body is not very movable in the cavity of the viscus, and its extremities are pushed against the walls and wound them. Upon looking over the numerous cases which have been reported since 1830, I have found some accidents secondary to

extraction, and these belong to two different classes. Some follow the manipulations of the instruments in the bladder and the lesions produced by the foreign body during the attempts at mobilization, prehension, or extraction. Others, on the contrary, are produced during the extraction through the canal, and are due to the impossibility experienced in completing the operation, in consequence of the resistance which the canal offers to the passage of a foreign body which has become too large, either from the deposit of calcareous concretions, from becoming folded, or from unfolding when the body is a rolled cylinder (paper, leather, linen, cloth).

I will now mention a few cases of each variety. The lesions produced by the foreign body while it is being seized and withdrawn may terminate in a perforation, peri-vesical abscess or even in peritonitis.

Observation.—Ear-pick in the bladder.—Division.—Death from peritonitis.—An effort was made, with the aid of instruments, to remove an ear-pick which had been in the bladder for three days, but all attempts failed. A stone-shears was then used to divide it into several pieces, one of which, two centimetres in length, was expelled. An attack of fever developed, and the patient died of peritonitis five days later. At the autopsy an abscess as large as a nut was found between the bladder and rectum. There was some cystitis, and a round opening filled by the foreign body which projected into the abscess. (Bulletins de thérapeutique, 1847, p. 33.)

In addition, there are manipulations of extraction, which crush a dangerous foreign body like a glass tube, the sharp pieces of which may produce grave disorders. We must not expect that matters will always terminate so fortunately as in the following case, taken from Civiale's practice:

Observation.— Extraction of a glass tube from the bladder.—Civiale had to extract a glass tube, 0.08 m. long and 0.006 in diameter, which an individual had introduced into the bladder. The surgeon succeeded in grasping one end, but it broke under the pressure of the forceps. A piece 0.035 m. long was removed, and he was then compelled to extract sixteen other pieces in succession. (Bulletins de l'Académie de médecine, T. 25.)

Despite the final success, this case undoubtedly does not speak in favor of extraction through the natural channels, and it shows that the tractions performed must be very strong and consequently done blindfold, as this body had been broken into a large number of pieces.

However advantageous the extraction through the natural passages may be, we must not, in the presence of certain cases, forget that it is sometimes clearly contra-indicated. The foreign body in the bladder must not alone be seized, but it must also be extracted, and, in order to do this, the urethral canal should not be injured. Surgeons have sometimes been compelled to leave the operation unfinished, because the foreign body could not pass through the membranous portion, and it has been necessary to extract it by the "button-hole" operation.

I do not think that we can regard this subsidiary operation as a regular method, because, in addition to the dangers incurred by extraction through the natural passages, are those arising from incision of the perineum and canal, and the ruptures attending them. When the nature of the foreign body is known in advance, when we know that an abnormal dilatation of the canal will be necessary, or that the latter is narrow on account of the existence of a stricture, we must resort to lithotomy rather than to the performance of the necessary manipulations of extraction (which are always distressing and sometimes dangerous), and the secondary incision. In support of this view, I will mention the following cases:

Observation.—Attempted extraction of a piece of a catheter arrested in the urethra. —External urethrotomy.—An old man, suffering from a prostatic affection, had a piece of catheter in the bladder. The instrumental manipulations made in order to extract it were successful in grasping it, but it was impossible to withdraw it through the membranous portion, and it became necessary to perform external urethrotomy, which permitted the removal of a long piece of a catheter, which had already become covered with phosphatic deposits. Recovery. (Gaz. méd. de Strasbourg, 1876, p. 135.)

Observation.—Roll of patent leather in the bladder.—Incomplete extraction.—"Button-hole" operation.—Foucher attempted to withdraw from a man's bladder a small roll of patent leather which had been introduced a short time previously. This man had had lithotomy performed upon him five years previously by Voillemier. Foucher employed Mercier's duplicator in the extraction, but the foreign body, which had unrolled itself, could not pass any farther after arriving at the bulb, and the instrument became loosened. It then became necessary to perform the "button-hole" operation, which permitted the extraction of a piece of patent leather incrusted with calcareous matter. (Bulletin de thérapeutique, T. 59).

Whenever a foreign body has remained in the bladder for some time, it is well to guard against the phosphatic deposits which, by markedly increasing its size, may prevent its complete extraction, and consequently necessitate the performance of lithotomy or the button-hole operation.

A recent discussion in the Surgical Society (1878) enables us to determine the personal sympathies of certain surgeons with regard to extraction. Lannelongue is a partisan of this plan, but is not exclusive. Verneuil does not have any great confidence in extractors; Després goes farther, considers them deceptive, and, forgetting the past and present, has even gone so far as to say that there are no cases in man in which pieces of a metallic catheter were removed by these instruments.

If extraction through the natural channels present dangers, this is also true of lithotomy. Apart from the multiple accidents and complications common to this operation, the hemorrhagic urinary infiltrations, peri-vesical abscesses, it also presents some others which result from the difficulty of extraction. If the small or ovoid foreign body is entirely covered by friable deposits, the operation of lithotomy will offer nothing abnormal. But if there is no incrustation, and especially if the latter does not sufficiently protect the points or ends of long and hard foreign bodies, the difficulties in the search and extraction may be very great, and they are sometimes such that the surgeon has been compelled to leave the operation unfinished. Finally, when the foreign body is embedded in one of the walls of the bladder, the manipulations are very painful, and especially very dangerous, because all the tractions are performed barely a few millimetres from the recto-vesical cul-de-sac of the peritoneum.

Observation.—Death in consequence of extraction by lithotomy.—Pouteau speaks, among other cases, of a stone as large as a hen's egg, traversed in its long diameter by a very long pin which the patient used in order to push back some gravel which prevented micturition. It was removed by lithotomy. Unfortunately, the stone was removed crosswise, and the two ends of the pin produced such extensive ruptures that the patient died within a few days. (Pouteau: Mélanges de chirurgie.)

We see from the preceding remarks, that none of these two methods is free from all reproach, and that the prognosis of foreign bodies of the bladder is somewhat less satisfactory on this account. Nevertheless, when indispensably necessary, we must extract at any age, whatever may be the nature of the foreign body. It appears to me that Denucé has correctly appreciated the importance of this question, and that he has drawn his conclusions from an observation of facts, when he writes:

"Lithotomy is simple in its performance, but dangerous in its results; extraction is usually harmless, but unfortunately it cannot always be performed, although the efforts of modern surgery are continually striving to smooth over the difficulties which it presents."

During the twenty years which have elapsed since Denucé wrote these lines, the question has made no further progress, and if we rely on the opinions and statements of surgeons, it may, perhaps, be necessary to restrict somewhat the importance and utility of extraction through the natural passages. The large practice and the skill of these surgeons render their views well founded. How often are these measures of extraction more unreliable in the hands of surgeons who are less expert in the management of instruments! Can we expect physicians, who rarely have occasion to use this special arsenal of instruments, to possess great dexterity, if they have never been exercised in their management? We must also conclude, in a general way, that we should begin, in all cases, by making efforts at extraction; but they must not be prolonged unwarrantably, and, if they fail, it is better to resort to lithotomy.

The following table will enable us to follow a rational course in the employment of therapeutic measures, and to apply to each category of foreign bodies the special treatment which it requires, beginning, if possible, with the methods of extraction through the natural channels, and ending with lithotomy if the others fail.

Table of Therapeutic Indications for Foreign Bodies of the Bladder.

- **Foreign bodies.**
  - **Present for a short time.**
    - **Elongated foreign bodies.**
      - Ovoid foreign bodies. → Extraction through the natural channels, prehension, crushing, lithotomy.
      - Soft and flexible..... → Duplicators, prehensors, basculeurs, lithotomy.
      - Hard.....
        - Rigid.....
          - Metallic..... → Prehensors. Basculeurs. Lithotomy.
          - Non-metallic.... → Prehensors. Basculeurs. Shears. Lithotomy.
        - Flexible..... → Prehensors, basculeurs, duplicators, lithotomy.
      - Fragile..... → Basculeurs, prehensors, lithotomy.
  - **Old, with concretions.**
    - Bladder in good condition.....
      - Ovoid foreign bodies. Calculi of small size. → Crushing, extraction.
      - Elongated and rigid foreign bodies. → Lithotomy, crushing.
      - Long, flexible. → Crushing, prehension, lithotomy.
    - Bladder in poor condition.....
      - Ovoid calculi of small size. → Mild attempts at crushing, lithotomy.
      - Long foreign bodies and calculi. → Lithotomy.

FOREIGN BODIES OF THE FEMALE GENITO-URINARY ORGANS.

The study of the foreign bodies of the female genito-urinary organs includes those which have been introduced into the vagina, uterus, urethra, and bladder. On account of the difference in the nature of the symptoms and treatment, I have thought that it would be best to divide this general study into several distinct chapters. However, the close relationship which exists between foreign bodies of the female urethra and bladder explain why their history should be united in one chapter.

FOREIGN BODIES IN THE VAGINA.

CHAPTER I.

Some classical authors consider foreign bodies of the vagina as very frequent compared with those of the other natural canals. But a serious study of the subject enables us to see that this is not so, and that of all cavities which are readily accessible this is perhaps the one which is least frequently the site of foreign bodies. This is, moreover, very readily explained, if we reflect upon the dimensions which this organ may acquire and upon the facility with which the introduced finger may extract such bodies, which, being small and regular, do not present any resistance.

Despite these restrictions, the list of vaginal foreign bodies includes the most varied objects, as we can see by reading the following table, which is arranged in the order of frequence:

Table of Foreign Bodies of the Vagina.

Foreign bodies of the vagina....	Pessaries.	Goblet.	Tin cup.
	Spools.	Sponges.	Leech.
	Needle-cases.	Threaded needle, ivory needle.	Handle of a brush.
	Bottles		Piece of a glass syringe.
	Neck of a bottle.	Box of pomade.	Various needles.
	Beer-glass.	Compass.	Hair-pins.

Size of Foreign Bodies of the Vagina.—The well-known elasticity of the vagina sufficiently explains how foreign bodies as large as bottles and goblets have been introduced, and if we recall the dimensions

which the vulvar orifice slowly acquires during labor at the moment of the passage of the fœtal head, we will no longer be surprised that, in consequence of habit or from the effect of slow manipulations, this varied series of objects has been introduced without rupture. Some have very large diameters, such as glasses, a preserve-jar, to which Lisfranc refers, etc.; others, on the contrary, are only enlarged in one plane: this is true especially of pessaries, which are readily introduced on edge and are placed in the vagina in order to support or replace the uterine neck. The size of these bodies is only limited by the walls of the pelvis—that is to say, they may be as large as a fœtal head, measuring nine to ten centimetres in diameter. But they do not attain these limits, as a rule, though they none the less produce serious accidents by their presence.

Shape of Foreign Bodies in the Vagina.—These bodies are usually regular and rounded. They must always be blunt in order to be introduced into the vagina, otherwise they will tear the parts and drive back the mucous membrane, and produce serious disorders. Cups, pessaries, spools, etc., are regular; sometimes the bodies are elongated, like the handle of a brush, referred to by Erichsen, knitting-needles, hair-pins, a compass in a case cited by Sonnié-Moret.

In the latter event, the foreign bodies are often placed crosswise or obliquely, and are retained in the vagina by being embedded in the walls. In this respect their mode of fixation differs markedly from that of round and very large bodies. While the latter are retained in the canal by the contractions of the muscular coat, which is very powerful and which immobilizes the body, the latter, on the contrary, are fixed in the wall, which becomes perforated by contracting upon them.

The bodies present a considerable length in some cases. A girl, mentioned by Hilton and observed in Guy's Hospital, had introduced into the vagina a threaded needle made of bone and ten inches in length. Another case referred to the handle of a brush of cedar-wood and measuring five and a half inches.

Another interesting property of vaginal foreign bodies is their composition: some are made of metal, like certain pessaries, of silver, copper, tin (cup), wood (spools), ivory. But there are a very large number which, from their composition (glass, porcelain, stone-ware) are fragile and constitute a separate class, which is especially interesting with regard to treatment. It sometimes happens that they break, and become dangerous to the adjacent walls and to the surgeon.

Sometimes they are solid, like spools; at other times they are hollow and have a large opening, like a glass or cup, or a narrow opening like a bottle. Finally, there are some which, like metallic pessaries, are provided with an internal cavity closed on all sides. In this category we must include the needle-cases, which sometimes contain pins and needles. These are not idle considerations, because the vaginal mucous membrane may penetrate into all these cavities and give rise to the curious phenomena of invagination, examples of which are not by any means rare.

Hitherto we have only considered solid and resisting foreign bodies, which offer a fixed point of support to the contractions of the organ; but some, possessing a soft consistence, are lost in the depths of the vagina. These include sponges which have been left in the vagina for a long time, and which are only retained in this position by the elasticity of their tissue. They also embrace leeches which have been accidentally introduced into the organ, and which become fixed to the walls, gorging themselves with blood. They impart a very deceptive sensation to the touch, and

one which, as we shall see, is very easily mistaken for other grave affections, especially when the body is situated deep within the vagina, as almost always happens.

Situation, Mobility, Fixation.—The foreign bodies are never observed at the vulva; they are situated, by preference, in the deeper parts. Even when very large objects have been arrested, the vulva is not open, and it is only after having separated the labia that we can detect any strange anomaly. Thus, as I have previously stated, bodies of a regular shape are always large and are retained by the circular contraction and elasticity of the walls of the vagina. As these bodies almost always have a cylindrical or cylindro-conical shape, the pressure is exercised in preference upon the two extreme and most projecting planes, and at these points it is very considerable and may even be sufficient to strangulate the adjacent parts. These adjacent parts are almost entirely wanting on the sides, which are more relaxed and extensible, while the urethral canal, fundus of the bladder, and rectum, are found in the antero-posterior plane; these are the parts which support the effects of the pressure. Hence the perforations of these organs are the most frequent of all the graver complications due to the presence of foreign bodies in the vagina. There is a complete analogy between the action of the fœtal head, (which remains in the vagina for an abnormally long period,) and this entire class of objects. This is the only point of view upon which Delpech can fall back in order to explain the heterotopy of his study of labor, which he annexes to that of foreign bodies. I have supposed that the axis of the object coincides with the long axis of the vagina, as most frequently occurs. The reverse arrangement has been sometimes observed, the axis of the object being more or less oblique to that of the vagina. This results in an irregular dilatation of the vagina, a greater lateral pressure, and new conditions of fixation. The body, a cup for example, being situated obliquely, sometimes pushes, by means of its extremities, the upper wall to the right, the lower wall to the left, a little behind on one side, a little in front on the other, and the mucous membrane is cut upon the sharp edge of the vessel. This is the cause of the difficulties in extraction, because the fixation is then very marked and the most projecting parts can only be disengaged with great difficulty. Under what influence do these displacements and inclinations of the axis occur? It is very difficult to determine this accurately, but it appears probable that the efforts made by the patients to withdraw them are not indifferent with regard to their production.

When long foreign bodies are situated in the axis of the vagina, as very rarely happens, they are not very steady. But this is not true of those which are situated more or less obliquely, and whose ends are imbedded in the walls, sometimes on one, sometimes on both sides.

Observation by Briess.—Pin in the vagina.—A robust servant, æt. twenty-three years, stated that she had been suddenly seized with pains in the abdomen six days prior to her admission into the hospital. These pains kept on increasing, and were attended with strangury and constipation. No tumor was discoverable anywhere. Palpation of the left half of the abdomen produced great malaise; the patient was menstruating. On the fifth day after her entrance into the hospital, and after the menses had ceased, the vagina was examined, and a foreign body was recognized, which was narrow and firmly embedded in the posterior cul-de-sac of the vagina. The extraction was performed with difficulty with a pair of forceps, and the body was found to be a pin, which was slightly bent in its upper third. After the extraction the pains ceased and recovery occurred. (Wien. med. Presse, IX., 1868, and Schmidt's Jahrb., 1870, V. 147, 308.)

CHAPTER II.

PRIMARY SYMPTOMS AND ACCIDENTS.

The differences between the various foreign bodies and the symptoms to which their presence gives rise, are so great that it is proper to make a distinction between those which, like glasses, bottles, etc., immediately produce functional disturbance, and those which are well tolerated by the vaginal canal. We must entirely eliminate from this chapter all pessaries introduced for surgical purposes, and which are not only well tolerated, but often even produce relief from old pains and from very marked functional disorders; in addition, all spools, sponges, etc., whose primary innocuousness is absolute, and whose presence is entirely compatible with the maintenance of health. The symptoms and accidents produced by the presence of large foreign bodies belong to three categories: 1, subjective symptoms; 2, functional disorders; 3, objective symptoms.

1. Subjective Symptoms.—Pain appears at an early period after the introduction of large foreign bodies, and it hardly ever disappears as long as the latter are present. It is due to the pressure of the walls of the vagina upon the projecting angles, and, at the same time, to the abnormal dilatation.

It is very difficult to define this pain, and authors are not explicit upon this point in their observations. It appears to be both a feeling of weight and a dull pain which is similar to vesical and rectal tenesmus, and inspires the patients with false fears. We must also add that pain is produced by the irritation of the vagina, which soon follows the introduction and which results from the permanent contraction of the muscular coat. It is radiated into the kidneys, perineum, and thighs, and has considerable analogy with the pains of parturient women during the period in which the head presents at the vulva.

2. Functional Disorders.—The phenomena of compression produce very serious symptoms in the vicinity, and these may become very grave if they persist. They include the retention of urine and fæces, which are due to the distress produced by their expulsion. At the same time we may also observe menstrual disorders from the mere fact of the vaginal obstruction, which no longer permits the discharge of the secretions and fluids formed above the point occupied by the obstacle. The accidents in the vicinity do not always appear immediately after the introduction, but at the period in which the reaction produced by the presence of the foreign body commences. In fact, the already very great pressure caused by the object is added to that which results from the swelling of the mucous membrane and of the submucous cellular tissue, so that the obstruction of the excretory canal of the urine may gradually become complete. The retention of fæces is very rarely complete, as in the case reported by Bayard, and even after a little while and without any surgical interference, the passage of fæces is re-established, with alternations of constipation and diarrhœa. Masses of fæces form and are expelled *en masse* at the moment of the discharge.

On the part of the bladder, the primary retention disappears, or perhaps it even terminates in a very painful and annoying incontinence. In the beginning, all the efforts at micturition lead to nothing and produce

an exacerbation of the vesical and rectal pains. At a little later period, the bladder expends its contractile force in fruitless efforts; the water, flowing drop by drop, is changed, becomes strongly ammoniacal, flows over the genitals, which it irritates and inflames, and soon gives rise to a putrescent odor.

Nevertheless, the suffering produced is not sufficient to compel the patients to confide their story to the physician, and in almost all cases they do not determine to do this until much later, after the secondary symptoms have appeared.

3. Objective Symptoms.—The irritation produced by the presence of the foreign body causes an increase, and at the same time a rapid change in the vaginal secretion, which immediately becomes nauseous, and then muco-purulent in a very short time. Little by little the external genital organs become swollen, and the finger, when introduced into the vagina, enables us to recognize a large ridge of mucous membrane whose origin it is difficult to explain, if we do not know the nature of the accident, and if the hollow foreign body like a drinking-glass is open on the side nearest to the vulva. This ridge is formed by the swelling of the vaginal mucous membrane in front of the anterior border of the object. If the body is solid or if a portion is outside, the finger encounters an abnormal convex obstacle, which is almost entirely immovable, and the outlines of which it is impossible to determine, so great is the force of the constriction pressing upon it. The bladder, which is full of urine, projects above the pubis, where it may be very clearly defined by percussion.

The primary symptoms produced by the presence of pointed foreign bodies are somewhat different, because they act in another manner, by producing pain and frequently a lesion of the wall in a very localized spot. If the foreign body is pointed, it may give rise to a perforation which follows a different course in different cases. When the peritoneum is wounded, a fatal peritonitis develops and rapidly carries off the patients in the large majority of cases. At other times, after the perforation, the foreign body progresses insensibly into the cellular tissue of the pelvis and gives rise to other accidents after a more or less remote period. But this passage rarely occurs at the onset, and I will postpone its investigation to the discussion of the secondary accidents.

CHAPTER III.

LATE ACCIDENTS.—TERMINATIONS.

Tolerance.—Duration of its Presence.—If we compare the period at which the foreign bodies have been introduced—I now refer to the most numerous ones, pessaries for example—with that at which the patients begin to complain, we will find very marked differences. Thus, it is not rare to find that an old woman will seek advice with regard to accidents produced by a pessary which has remained in the vagina for ten, twenty, or twenty-five years, and which has even escaped her memory. In another case, a wooden spool was found in a woman thirty-six years of age, who had introduced it during some lewd practices at the age of

fourteen. I have taken extreme cases, but there are many of the same kind, and it is only very large, pointed, or cutting foreign bodies which force women to consult a physician.

The period of latency or tolerance of vaginal foreign bodies is therefore very long, and we are inclined to attribute to them a comparative benignity which is merely apparent. Many of these women have, for a number of years, complained of symptoms to which they have not paid much attention, and some have suffered from peritonitis or hemorrhage. Especially vesico-vaginal fistulæ—that disgusting disease—may exist in some of these patients for a long time before they seek assistance, so great are the negligence and uncleanliness of certain females, especially at an advanced age.

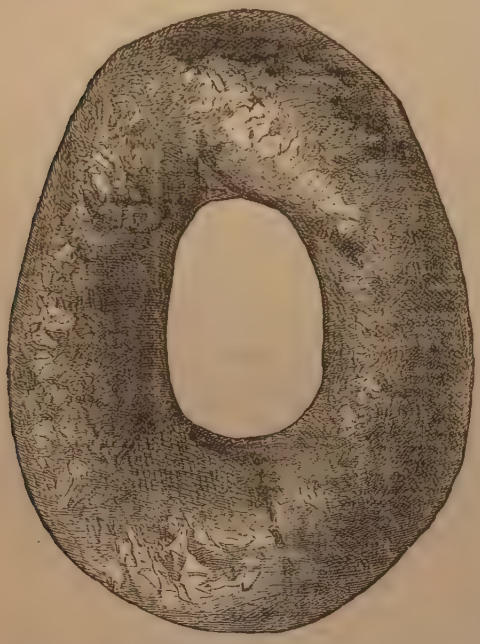


Fig. 71.—Pessary incrusted with phosphatic deposits after a long stay in the vagina. (Dupuytren's Museum.)

Incrustation.—Various Changes of the Foreign Bodies.—During the long period of relative tolerance which intervenes between the introduction and the appearance of grave symptoms, the foreign bodies undergo a certain number of changes and transformations, the most frequent of which is incrustation with calcareous deposits. On account of the shape of the foreign bodies and their very considerable size, we can understand that these concretions are only sufficiently thick and extensive to form a vein-stone over the foreign bodies, the surface of which they partially cover. In speaking of incrustations, therefore, we only refer to a mass partially organic, partially calcareous and phosphatic, which is deposited at those points in which the foreign body is not in direct contact with the walls, for the body preserves its ordinary appearance in these situations, if there is no perforation. Very frequently, when the physician is called to observe one of these concretions, the local disorders have already attained a considerable intensity and an urethro-vaginal or vesico-vaginal fistula is present, so that the action of the changed urine is added to the special causes of incrustation in the vagina and contribute largely to the increase of the concretions. But it is very well known that they also exist apart from urinary perforations, and a very long time need not elapse before we can detect their presence. Thus Hubbauer[1] relates that he found, in the vagina of a girl nineteen years old, an incrusted glass which was very firmly embedded; it had been there for six months, and the surgeon experienced great difficulty in performing extraction. The

[1] Wurtemburg Journ., 1862.

first cause of the incrustation consists in the change in the secretion of the mucous glands of the vagina; the latter, becoming inflamed, secrete a fluid whose odor, abundance, character and extreme richness in salts prove the change, and the foreign bodies, by a sort of special selection, become the centre of these deposits, which, being at first isolated in points, finally unite and become granular, of slight consistence, and very nauseating. At a later period, when a vesical perforation has been produced, the portion which projects into the bladder may become the site of a calculous concretion of vesical origin, and the urine, flowing along the foreign body into the vagina, continues its action upon the latter. Holmes relates that the neck of a bottle was found in a woman's vagina; a piece of the glass had entered the bladder, and a calculus had formed upon it as well as around the vaginal portion.[1] Sometimes even the mere existence of a perforation favors the formation of one or more vesical calculi, although the foreign body has not penetrated into the bladder. In one case which will be reported farther on, they numbered no less than five, which were contained in the recesses of a pouched bladder.

All foreign bodies appear susceptible of receiving incrusting deposits, but there are some, like cloth, wood, glass, which present a greater predisposition. Sponges which have been forgotten in the vagina may also, according to Capuron and A. Cooper, become the site of very firm and irritating incrustations. Metals, on the contrary, are more refractory, unless the nature and properties of the secretion should not be the same in all individuals, a thing which is possible and may explain the singularity of the following case, taken from Morand's learned treatise.[2]

Observation.—Prolonged presence of a silver pessary without incrustation.—Perforation.—A woman, who was more than sixty years old, had worn a silver pessary for several years. Morand being called, found the pessary surrounded by more or less firm fungous excrescences, and decided that it was necessary to remove it. But this was found to be very difficult; the pessary appeared to be attached and fixed in several places, and it could only be withdrawn after some violence and rupturing several of the bands which held it. When he had removed the pessary, Morand was very much astonished to find it perforated in several places, apparently from the effect of the acid matters which were secreted by the vagina. These irregular openings were filled by portions of the internal membrane of the vagina, which, having swollen and elongated in the thickness of the pessary, there formed hooded excrescences which retained putrid matter in the cavity of the pessary. Slight hemorrhages and some pain, which yielded very quickly. A cicatrix formed and had the good effect of producing recovery of the prolapsus uteri.

However, it is not necessary to invoke the corrosive action of the vaginal secretion in order to explain the changes in some foreign bodies, such as cork. The mere prolonged stay in this moist, warm locality, is amply sufficient. Hence, there is nothing astonishing in the fact that Chopart, upon withdrawing an incrusted foreign body from the vagina, found the cork pessary, which formed the nucleus, entirely rotten. A similar instrument withdrawn by Gosselin[3] had remained in the vagina for thirty-two years! It was incrusted with calcareous salts. But metals are always attacked by the vaginal fluid, and much more markedly than by many of the other fluids of the organism. Thus, at the autopsy of a woman who had had a cup in the vagina made of an alloy of tin, oxide of lead was discovered in the gangrenous detritus.

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[1] London Medical Gazette, 1854.
[2] Mem. de Morand: Anc. Acad. de Chirurgie, 1877, p. 421, obs. XI.
[3] Gaz. des hôpitaux, 1846.

Later Accidents.—1. *Large foreign bodies.*—The accidents produced by the prolonged presence of foreign bodies consist of local changes and functional disorders in the vicinity. I will commence with the first because they constitute the cause of the others. The bodies act locally in two different ways, either by producing in the entire vagina, and especially around it, an inflammation which terminates in the formation of fungosities, or by giving rise, at one or more points, to perforations which are merely the results of gangrene from compression.

The inflammation is rarely very acute, and is limited to a chronic vaginitis, which is shown by pain, redness, and swelling of the mucous membrane, and by the abnormal secretion.

But matters run a somewhat different course in points which are subject to prolonged contact and continually press upon the surface of the body. The mucous membrane is sometimes eroded at these places over a very large surface, and a suppurating wound is thus produced. Around the foreign body the ulceration has a peculiar shape and assumes the fungous type, so that in front of the body is always found a large fold formed by the vaginal mucous membrane, and by the very large fungosities which cover it. On account of the swelling it follows that the two opposite walls of the vagina come in contact with one another in such a manner as to tend to obliterate the cavity of the organ. In some cases the tumefaction and fungosities were so developed that this arrangement has been very completely realized. Bérard has reported the case of a pessary which had remained in the vagina for twenty-five years, and which had finally produced almost complete obliteration. Instead of the normal vagina there only remained a cul-de-sac, which communicated with the remainder of the cavity and the foreign body by a small opening situated in the upper part. This part becomes especially prominent, and perhaps the efforts of defecation and the attempts of the patients are not indifferent in this respect. This is the direct opposite of what occurs at the close of normal labor.

The fungosities are very strongly developed when the foreign body is situated at the fundus of the vagina, and I will soon have occasion to refer to some errors to which they may give rise. When the foreign body is hollow, like pessaries or certain glasses, the fungosities penetrate into the orifice, which is left free, and contribute still more to the illusion.

The examples of perforation are relatively numerous; sometimes they involve the bladder, urethra, and rectum separately, sometimes at the same time. Upon compiling these observations it is found that the latter variety is least frequent. In Deneux's case, the perforation of the recto-vaginal septum had been produced by the stem of a ball-pessary. The crown was found to be retained by the vegetations; they formed a mass which was very similar to a cauliflower excrescence, and scarcely permitted the body and branches of the pessary to be touched in two places.[1] The mechanism of these perforations from gangrene is extremely simple. The vaginal, urethro-vesical, and rectal mucous membranes are continuously compressed for a long time between the foreign body on the one hand and the bony wall of the pelvis on the other. This results in localized sphacelus, which terminates in the slow formation of a loss of substance and an artificial communication between the bladder, vagina, and rectum.

Observation by Laroche.—Pessary.—A peasant woman, fifty-six years old, had been affected with prolapsus of the uterus for a very long period. After having neglected

[1] Journ. gén. de méd., 1822, T. LXXVIII., p. 197.

the disorder for nearly sixteen years, she consulted, in 1808, Janin, who applied an ivory ball-pessary, and advised her to remove it from time to time in order to clean it. The fear of hurting herself during this little manipulation, the carelessness of the majority of these country people, and probably the fear of paying the surgeon a few additional fees, caused her to forget the pessary and leave it in place. For four years she worked in the vineyard and felt no distress; during this time the pessary was bent backward. At the end of eight years she began to experience temporary difficulty, at times in passing urine, at times in going to stool. She remained in this state for three years. Finally, having yielded to the disease, finding a continual increase in the difficulty and pain which she had in passing fæces, and sometimes also in micturition—convinced, moreover, that a portion of the fæces escaped through the vulva, and a prey to the most disgusting uncleanliness, she again sought the surgeon. Janin found the upper part of the pessary bent backward, and more than half of the staff had penetrated the rectum, in which it could be distinctly felt. The first attempts at removal failed. In accordance with the advice of Percy and Villermé, incisions were made with a bistoury in order to disengage the pessary from the fragments which held it. After the operation the patient was able to walk a good quarter of a league in order to return home. The fæces gradually resumed their ordinary course, and at the end of a month only a small fistula remained.

The half of the staff which was in the rectum was covered with irregularities of a black color, very fetid, and covered with shining crystals. The portion lodged in a fold of the vagina was covered by a stony incrustation, which had, at its lower part, a slightly convex facet an inch in length (Journ. gén. de méd., 1822, T. LXXVIII. p. 200).

Schmuecker has related a case similar to the preceding one. The pessary was withdrawn at the end of ten years, and the patient recovered with a perforation of the rectum.

The proximity of the pubis, its shape and arrangement, sufficiently explain the fact that urethral perforations are the most frequent. When once formed, the fistulæ increase in size so that the communication may become very large. The passage of fluids and other substances is usually the rule after these perforations, but this does not always happen, and Dupuytren has reported a case in which, despite two large perforations of the rectum and urethra produced by an old pessary, the urine and fæces had never escaped through the vagina. This passage usually takes place, especially with regard to the urine, which flows more readily than fæces, and the patients find themselves afflicted with one of the most terrible infirmities. As a rule it is not until this period that they seek assistance. More than one woman has fallen a victim to this hideous carelessness or false shame, which prevents them from applying to a physician. Witness the following case, which is interesting from more than one point of view:

Observation.—Tin cup in the vagina.—Death.—A young girl, eighteen years old, was brought to the Hôtel-Dieu of Orleans, in a condition of terrible marasmus. She complained of intense pains in the abdomen, and of constant diarrhœa. The only information which could be obtained from this girl, who bore on her face the stamp of idiocy produced by the habit of masturbation, was that she had complained of the same sufferings since May 14th. She died the day after her admission to the hospital, and before she could be examined. At the autopsy the interior of the vagina was found to contain a hard, thin body, shining like metal, which, traversing the diameter of the organ, prevented it from entering farther. Upon separating the labia minora, the end of a slightly flattened tin cup could be distinguished, the orifice being turned forward and downward. This irregularly oval orifice was partially concealed by the perineum, against which it rested and which it pushed forward. This body could not be extracted until the symphysis pubis had been cut. The bladder was then opened: it contained five calculi, situated in pouches formed by the hypertrophic muscular layer. Upon following the urethral canal, it was found to have been cut at a distance of two centimetres from the meatus urinarius by the upper border of the cup, which pressed it against the posterior surface of the pubis, so that the urine, falling into the vagina, flowed upon the cup. All the surrounding tissues were gangrenous and infiltrated with oxide of lead. (Bull. de thérapeutique, T. XXXIV., p. 314).

If the surgeon does not interfere in order to remove the foreign body, —the cause of all the accidents,—death will occur sooner or later from marasmus, or in consequence of grave complications like peritonitis, abscesses or nephritis. In a case reported by Bagard,[1] of Nancy, a pessary produced strangulation of the rectum. The cause was not recognized until the autopsy.

Some complications have been noted during the presence of the foreign body; these are: hemorrhages caused by ulcerations and fungosities, metritis and metro-peritonitis, cystitis and rectitis. We must also add phlegmons of the pelvis and abscesses of the iliac fossæ.

After the preceding remarks it will suffice to note the grave functional disorders produced by the prolonged presence of the foreign bodies in the vagina. On the part of the urinary secretion, I will refer to the alteration of the urine, retention followed by incontinence, either from overflow or on account of the perforation. On the part of the rectum, obstinate constipation is at first observed; this only disappears in order to give place to an uncontrollable, purulent diarrhœa, resulting from perforations or changes in the mucous membrane of the rectum. Finally, to these accidents must be added the disturbances of the menstrual function, which is very much interfered with by the obstruction of the vagina. In old women, who have forgotten the introduction of a pessary, this inconvenience is not present. But in younger women, pains and the entire group of symptoms of uterine retention, metritis and metro-peritonitis, are manifested at each menstrual epoch. These accidents rarely reappear, either because the function is less thoroughly effected, or because the general health, which is gradually affected, produces at first dysmenorrhœa, and finally, complete amenorrhœa.

2. *Long foreign bodies.*—I know of no example of long and pointed vaginal foreign bodies which have remained for a long time in the canal, because they rapidly produce fatal accidents of perforation or pass into the cellular tissue or abdomen. After having remained harmless in the cellular tissue for a longer or shorter period, they may make their way into a loop of the intestines or form a fluctuating tumor under the skin of the groins or hypochondria.

Observation.—A foreign body, introduced into the vagina, passes into the abdomen.—Extraction.—Death.—A woman, aged twenty-eight years, being surprised by some one entering her room as she was introducing a cedar-wood brush into her vagina, seated herself in order to conceal the act in which she was engaged, and the stick of wood was suddenly pushed through the posterior wall of the vagina into the peritoneal cavity. Two loops of intestines were undoubtedly perforated, as was shown later on autopsy; nevertheless, no extravasation occurred into the peritoneum. Plastic exudation agglutinated the intestinal loops to one another around the foreign body which perforated them, and was situated in such a position that one end rested in the concavity, and the other, directed upward and forward, had pierced the abdominal wall between the umbilicus and Poupart's ligament, nearly under the skin.

Erichsen performed extraction eight months after the accident. He assured himself that the brush was fixed in its middle portion by some of the tissues which it traversed; finally, that the point, which was felt on abdominal palpation, was engaged in the anterior wall. The patient was anæsthetized, and the bladder and the rectum were emptied; an assistant then introduced a finger into the rectum and pushed the posterior end of the brush upward and forward, so as to make the point project as high up as possible. An incision was made upon this projection down to the fascia transversalis, in which the point of the brush, made of blackened lead, was fixed. Erichsen enlarged the opening in the fascia, pushed back the tissues, and exposed to view a very

[1] Marquet: Traité de l'hydropisie, 1770.

long piece of the brush, which he seized and extracted with the aid of a pair of forceps. The brush, which was five and a half inches long, had a fæcal odor. Nevertheless, neither gas nor intestinal contents escaped through the wound, which was closed by two stitches and adhesive plaster. On the following day, a severe attack of peritonitis developed, and the patient died on the fourth day after the operation.

At the autopsy, the peritoneum was found to contain gas and a few ounces of turbid serum, of a blackish color and containing plastic exudations. A mass of small intestines, which were bound together, was found half way between the umbilicus and pubis, to the right of the median line. Two loops of intestines were found perforated, each in two places. The bladder, uterus, and rectum were healthy; but, upon examining the vagina, a depressed cicatrix was found in the superior posterior cul-de-sac to the side of the uterus. The brush had undoubtedly penetrated through this opening. (Med.-chir. Trans., V. XXXIX., p. 15, and Dict. Encyclop., art. Abdomen.)

In truth, the history of these bodies belong, as much to those of the abdomen as of the vagina, but useful information can be drawn from this very rapid passage in the pelvis. This example is not, however, isolated, and presents more than one analogy with the following:

Observation.—Knitting-needle in the vagina.—Abscess.—A woman, twenty-eight years old, a deaf-mute, presented herself at the clinic with an abscess on the right side of the abdomen, which was especially prominent between the spine of the pubis and the umbilicus. A puncture made with a trocar permitted the escape of altered pus and gas. Upon enlarging the incision, and making an exploration with the finger, a somewhat roughened, very thick knitting-needle was felt, and was removed with a pair of forceps. The cavity was quickly cleaned; no fistula; recovery. The needle must have been introduced through the vagina or rectum. This hypothesis was verified by the discovery of a small cicatricial induration in the vagina, on the right side of the neck.

Despite these cases, the history of elongated vaginal foreign bodies is not sufficiently advanced to enable us to do more than quote a few cases which appear to belong here. In Sonnié-Moret's case, death resulted from the introduction of a compass, and was caused by an acute perforation.

CHAPTER IV.

DIAGNOSIS.

A VAGINAL examination can alone give us precise information, but we must also add rectal touch and vesical catheterism as useful adjuvants. If the first enables us to recognize the existence of solid foreign bodies, the latter furnishes very useful data concerning the existence of an urethro-vesical or rectal fistula. Finally, if the touch is necessary in the case of solid foreign bodies, it is absolutely indispensable to examine the vagina in ordinary light with the aid of a speculum, in order to discover the nature of soft foreign bodies like sponges. Despite the apparent simplicity of the diagnosis, very large foreign bodies often pass unnoticed, or have given rise to gross mistakes in diagnosis. That this is so becomes evident when we consider that a wooden spool had remained for twenty-two years (from the age of fourteen to thirty-six), in the vagina of a woman, although both her husbands and the physicians who were summoned to

attend to her had not detected its presence ! The following is the history of this curious case:

Observation by A. Pearce.—Spool of thread in the vagina for twenty-two years.— Various accidents.—A woman, æt. 36 years, sought advice for a menorrhagia which had lasted ten days, and had produced great prostration, very intense colic pains, and weakness. Upon examination, a body was felt, covered with a fold of mucous membrane, and an inch from the entrance. The patient finally confessed that at the age of fourteen she had herself introduced a spool of thread. She had previously had attacks of peritonitis and hemorrhage. Extraction was performed, and a urethro-vaginal fistula was found. The spool was black; the central canal, through which the menstrual discharge had always passed, was clear.

This patient, although twice married and under the care of physicians, had succeeded in concealing from them the existence of this body, which was three-quarters of an inch long. (Brit. Med. Jour., June 28, 1873.)

The fungosities which surround the foreign bodies, especially sponges, may be mistaken for cancers. The ready hemorrhages, the soft feel, the putrid odor of the secretions,—all the appearances are deceptive; and, in fact, examples of such a mistake are not very rare.

Observation.—Sponge in the vagina simulating carcinoma.—A pregnant woman at full term was examined by a physician, who made a vaginal examination and thought he detected a cancerous degeneration, with prolapsus of the neck of the uterus. Capuron being consulted, and finding that the patient's general health did not correspond with the supposed organic change, made a more careful examination of the parts, and removed a sponge from the vagina. (Vidal de Cassis, T. V.).

The same mistake was made by Richet. Cloquet relates that a woman was treated for cancer of the vagina, and that he removed from her a cork pessary which was incrusted and surrounded by fungosities. Finally, another example has been published more recently.[1]

To record these mistakes is equivalent to pointing out the way to avoid them, and a careful examination will always reveal the true cause of the deceptive symptoms.

In the same way that leeches become fixed in the pharynx, glottis and anus, they may also be present in the vagina, and simulate the most serious uterine affections on account of the hemorrhage, which is the only symptom of their presence. A simple examination with the speculum will prevent us from committing this error; nevertheless this mistake has been made, according to the observation reported by Guyon (1843).

Observation.—Leech in the vagina.—Errors of diagnosis.—Guyon communicated to the Academy of Sciences (1843) the case of a woman who had long been unsuccessfully treated in Bône for a profuse uterine hemorrhage. The flow continued until she changed her residence to Alger. She here came under the care of Lebrun, who also employed several remedies without any success. The woman had become very weak, and he ordered her to make vaginal injections of vinegar and water. Hardly had she made use of this remedy when a live leech, of the variety so commonly met with in the country, fell from the vagina. The hemorrhage ceased at once, and the patient's health was promptly restored.

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[1] Chicago Journal, 1876.

CHAPTER V.

TREATMENT.

Immediate extraction is the treatment which must be applied in all cases of foreign bodies of the vagina, but the difficulties which are experienced vary greatly according to the different cases. However, the extraction of small or soft objects usually presents no obstacle, and in order to do this it is sufficient to make an examination with the speculum and to seize the body with polypi forceps, calculi forceps, etc.

Observation.—W. Henry Day (Brit. Med. Journ., June 13, 1874), quotes the case of a woman twenty years old, in whom a piece of a glass syringe was extracted from the vaginal mucous membrane. It measured seven centimetres in length, and one in breadth, and the points of the fragment were very sharp. It was braced transversely against the uterine orifice, and had a cutting edge near the vesico-vaginal septum, the perforation of which was apprehended. A speculum was introduced, and, by means of the ring of an umbrella, the piece of glass was removed from the folds of the mucous membrane so that it fell into the speculum and was readily removed.

But matters do not always run so smoothly when it refers to very large bodies, like beer-glasses, goblets, boxes of pomade or preserves, and pessaries, especially when these objects are incrusted, have produced vesical and rectal perforations, and are buried in the midst of a hernial mucous membrane, which is thickened and covered with fungosities. A pessary which has been present for more than twenty or thirty years creates a new pouch in the tissues, and it is very difficult to dislodge it. Nevertheless, we must first resort to simple extraction by making use of special instruments, such as Farabeuf's forceps, and forceps which enable us to move, dislocate, and extract the body. These manipulations must always be performed very cautiously, and the tractions must be continuous and moderate. In Deneux's case, an old pessary was buried in fungous growths, and upon exercising tractions upon the stem it broke. It was not thought prudent to remove the other portion, and death occurred three weeks later.[1] This example should not be followed; if we do not succeed, we must resort to other means. Thus, division of the bodies has been resorted to several times, when they were fragile or capable of being divided. With the aid of a hand-saw or a cutting forceps, the pessaries are divided into two or more fragments through the vagina, rectum, or urethra, if it can be done in the latter with more facility, or they are already perforated. This was done by Dupuytren in the following case:

Observation.—*Extraction by fragmentation of a pessary in the vagina.*—A woman, who had been obliged to wear an ivory ball-pessary on account of an affection of the uterus, presented herself at the Hôtel-Dieu in Paris. This pessary had been allowed to remain for a very long period without withdrawal. One day, as she was attempting to remove it, she broke the large stem from which pass the three branches that support the circle. The body of the instrument remained for several years without causing any annoyance, but pain finally developed, and the patient sought the assistance of art in order to have the body removed. Dupuytren explored the vagina and found that the two lateral portions of the circle were free in the canal, but that the others, the anterior and posterior, were imbedded in the mucous membrane, and could not be

[1] Journ. gén. de méd., 1822, T. LXXVIII., p. 198.

disengaged. When the finger was carried into the rectum, a small portion of the circle was found bare in the intestine, and the introduction of a catheter into the bladder proved to the surgeon that another portion had perforated and was laid bare in this organ. Nevertheless, the woman had neither an urinary nor a stercoraceous fistula.

The extraction presented very great difficulties. Dupuytren at first attempted to saw the circle in the rectum, but was unsuccessful. Then, with the aid of a very solid pair of forceps which he had constructed (each bit had a dull cutting surface which came in contact with another), he broke the circle in the rectum and vagina, and withdrew the two portions of the foreign body, which presented three kinds of teeth, the remains of the branches upon which the ring was supported, through each of these cavities. This woman recovered without manifesting any subsequent distress. (Journ. gén. de méd., T. LXXVIII., 1822, p. 206.)

When the foreign bodies are fragile and can be extracted, we must divide them or cut the perineum, in order to facilitate extraction. The fragmentation of fragile foreign bodies is dangerous, if care is not taken to guard the walls against the pieces. Pieces of pasteboard (Bijon of Quimperlé), metal, wood, etc., are used for this purpose. They are divided by means of forceps, scissors, or hammers.

Observation.—Extraction of a glass tumbler.—Bijon was called to a woman, aged thirty-eight years, living in the country, who had introduced a glass tumbler into the vagina. This had been done five days previously, and the woman could neither urinate nor go to stool; furthermore, the glass was broken.

Examination revealed an ordinary glass, grooved along a part of its length, and situated almost transversely in the cavity of the vagina. The bottom was situated deep to the left and above, and so far from the arch of the pubis that the end of the finger could not go around it. The mouth of the glass, on the contrary, was more accessible to the touch, and was readily found to the right and below. The tip of the finger found upon the edge a cutting notch about three centimetres in diameter. The shape and position of this break, which was only found on the vaginal surface, left no doubt that it was the result of unsuccessful attempts at extraction.

Upon introducing the finger through this notch, the glass was found half filled by a portion of the recto-vaginal septum, which here formed a sort of hernia. Thus, the bottom of the glass pushed against the bladder above and to the left; it had compressed the cervix and crushed the urethra in such a manner as to render every attempt to introduce the catheter temporarily impossible or dangerous, while inferiorly the break in the glass threatened to perforate the intestine. Rectal touch showed that this danger was imminent. It was therefore unwarrantable to attempt to seize the foreign body at the bottom in order to pull it forward and extract it in the same direction in which it had entered. An attempt was made to perform a sort of version through the rectum in order to bring the mouth of the glass opposite the vaginal orifice; but, at the first introduction, the surgeon severely wounded his finger upon one of the sharp angles of the break. Bijon, then introducing the finger as deeply as possible into the notch in the glass, gradually pushed back the intestinal mass. With the other hand he held a pair of forceps, which he gently introduced according as the ridge was reduced. When he was certain that the mass which had filled the glass was evacuated, and that the blade of the forceps had passed to the outside of the glass, this blade was firmly held there. In order to protect the intestine, he slid a slightly stiffened piece of pasteboard, a little larger than three fingers, well rounded at the end, and carefully oiled, along the forceps, following the external surface of the instrument. It then became necessary to begin the same operation a second time. A little pressure was then made above upon the bottom of the glass, and the urethra, which had been previously compressed, was then disengaged; a powerful stream of urine was discharged spontaneously, and the bladder was emptied. In order to protect the urethra against injury from the notch, it became necessary to introduce two additional sheets of pasteboard, one above and the other to one side, so that a solid wall protected the entire surface of the vagina. Simple extraction could not be attempted because the forceps could not be closed. The surgeon then determined to break the glass with forceps which had cutting blades. When the foreign body was sufficiently diminished in size, he extracted it in its entirety. An examination of the pasteboard showed how useful this novel apparatus had been. The sheet which protected the rectal wall was deeply cut in two places; it had been almost transfixed by one of the corners of the broken glass.

A large injection of water was thrown into the vagina, and a careful examination showed that the vaginal walls were intact.

The intestines resumed their functions; abundant evacuations immediately occurred, and the woman recovered at the end of a few days. (Bijon of Quimperlé: Gaz. des hôp., 1868, p. 339.)

We read in an English journal that a woman had a piece of a syringe in the vagina. A surgeon being called, succeeded in removing it by protecting his index finger with cloth and forcing it into the end of the syringe, as in a glove.[1]

Finally, incisions have been employed on several occasions in order to disengage a portion of the foreign body. Thus, Holmes reports that a metallic pessary was so firmly embedded that it became necessary to incise the perineum in order to facilitate its extraction. In a similar case Lisfranc made a posterior vulval incision. The final treatment is extremely simple. The patients must at first be allowed to rest for some time, the claims of cleanliness being insisted upon, and pre-existing complications and perforations must be relieved, at a later period, by the appropriate operations. The results of these measures are greatly aided by nature, which, after the extraction, has a great tendeney to close the fistulæ.

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[1] Brit. Med. Journ., 1874, T. XXII.

FOREIGN BODIES OF THE UTERUS.

Some scattered cases in literature, the majority of which were observed in women, who, for criminal purposes, had recourse to these manipulations in order to rid themselves of the products of conception, constitute all our actual knowledge concerning foreign bodies of the uterus. Strictly speaking, we might somewhat enlarge the plan of this chapter by including the study of the effects of the foreign bodies introduced into the uterus for surgical purposes during pregnancy, so that, by the side of criminally produced abortion, we must place abortion produced for therapeutic purposes.

But if we consider what actually occurs, we find that the surgeon merely makes a wound or rupture of the membranes by means of instruments or catheters *à demeure*, and the foreign body is then withdrawn. Criminal abortion, on the contrary, has several times given rise to the prolonged detention of the body which has been employed.

It is very difficult to understand the factors which cause these instruments to be lost. In this respect we must divide the cases into two categories, according as the objects are manipulated by outsiders—usually by midwives, who are not afraid to hook them upon the child—or according as the patients themselves, with the same end in view, but with much greater lack of skill, endeavor to introduce the foreign bodies. A rubber catheter has been found broken in the uterus after having passed through the neck. In another case an individual had introduced a catheter *à demeure* into the uterus for the purpose of producing an abortion, but the catheter slipped out, and the patient thought it would be well to push it in deeper, whereupon it disappeared.

The few cases of foreign bodies of the uterus which I have been able to collect all refer to objects which have common characteristics. They are long in order to be able to be introduced deeply, not large in order to enter the neck, and pointed in order to perforate the membranes, or at least to detach them; the majority are rigid. Brignatelli's case, quoted by Lisfranc, referred to a chicken-bone, concerning the origin of which many idle theories were adopted. We may say the same of the hair-pin observed by Meschede, which may have come from the bladder, intestines, or rectum, or may have been introduced through the vagina. An observation reported by Lisfranc referred to a piece of a catheter.[1] An abortionist, whose misdeeds are mentioned in Crouzit's observation, used a long seton-needle which measured no less than six inches in length. He lost it one day in a gravid uterus.

[1] Clinique de la Pitié, T. II., p. 527.

The wooden spit which Maisonneuve[1] removed from the uterus of a woman thirty years old, was 122 millimetres long, pointed at one end and twisted at the other. Finally the patient, whose history is given in an English observation, had used a gum-elastic catheter, which entirely disappeared.

All these bodies are characterized by their length, which is so great that they can never be entirely lodged within the uterus unless the latter is distended by a fœtus of five or six months. This fact is not an immaterial one, as it explains several complications which are possible during the presence of the body, on account of their very great diameter. In fact, they no longer remain even in the cavity of the organ, but are embedded in its walls, which they finally perforate, either partially or entirely. However, the manipulations employed in the introduction often produce these perforations, as is evident from the following case observed by Zuhmeister.

Observation.—Twig of a tree in the uterus.—Some time after the first manifestations of pregnancy, a woman used a branch of a tree in order to penetrate the uterus, and in order to keep it there she pushed it back so firmly that it was embedded in the region of the kidneys. This twig, which was six inches long and as thick as a goose-quill, remained in the pelvis for five months without the patient's knowledge, and finally perforated the rectum. (Schmidt's Jahrbücher.)

When the body was engaged in the uterus at the moment of extraction it was almost always not free, and special manipulations were necessary in order to extract it. Cases referring to foreign bodies of the uterus are so scanty that many points in their history are still very obscure. Their migration and displacements are still unknown, but the uterine contractions enable us to understand, up to a certain extent, the perforation of the uterus. This is not true, however, of the mechanism of their passage into the pelvis. Moreover, an object which is even as soft as a catheter has been known to pass into the peripheral cellular tissue.

The accidents produced by the prolonged detention of these bodies vary greatly according as the body has perforated the inner wall, or has remained in the organ. A piece of reed, which was tolerated during the first period of its introduction, only became disquieting at the beginning of the next menstrual period. The presence of an irritating body also produces uterine contractions, which are not indifferent in the genesis of these perforations. A few years ago, a German surgeon withdrew the steel capsule of Roser's hysterophore from the uterus of a patient who had been treated for several months for an uterine affection. This large foreign body had not produced any serious symptoms for four months. (Berl. klin. Wochr., 22, 1878.)

Symptoms of metritis are usually present, to which we may add those of peritonitis when a portion has passed beyond the walls. Both of these affections, occurring shortly after an abortion, seriously threaten existence; and in several observations we find that the patients, overcoming their fears and shame, come to seek the aid of the physician. Thanks to proper treatment, the grave initial symptoms may subside; but, if the cause persists, they reappear at the end of a longer or shorter period. This is well shown in Maisonneuve's case.

Observation.—Wooden spit, twelve centimetres long, in the uterus.—In 1840, a woman, age thirty years, a laundress, entered the Hôpital Saint Louis, in Maisonneuve's service. At the age of twenty-eight she had had a miscarriage at the fifth month of pregnancy, followed by grave symptoms of metro-peritonitis. She was compelled to

[1] Gaz. méd., 1841.

enter a hospital, in which a diagnosis was made of hyperplasia of the anterior part of the organ; she entered the hospital a second time for similar symptoms. A general run-down condition and considerable emaciation were observed; there was a wan, yellowish color of the skin, dejected expression, painful digestion, hectic fever occurring every night, and dull, steady pains in the loins and hypogastrium. The latter region was occupied by a hard, irregular, nodulated tumor, slightly painful to pressure, filling the pelvis and prolonged into the right iliac fossa. On the vaginal side the os tincæ was found to be slighty opened, permitting the finger to enter a little; then the neck and body of the uterus were lost in an irregular, hard, and perfectly immovable mass. With the speculum the separation permitted something whitish to be seen, which had, with the stylet, a wooden feel; the object could be circumscribed by passing the stylet forward and backward. Maisonneuve thought that a foreign body was embedded in the walls of the uterus, and first attempted to cut it with long scissors, in order to extract each end separately, but he was unsuccessful. He then engaged the two teeth of a long polypus forceps, the one in front the other behind, and made the foreign body yield a little on moderate traction. The carefully continued tractions succeeded in disengaging one end without much pain, and it was then easy to extract the entire body. It proved to be a wooden spit, 0.122 m. long, pointed at one end and twisted at the other. The relation which existed between the introduction of this piece of wood and the abortion was thus established. For eight days there was a relapse of the symptoms; they then ceased, but a tumor remained which was undoubtedly due to the old adhesions between the uterus, bladder, rectum, etc. The general health was gradually restored. (Gaz. méd.)

There are two known cases of concretions which have formed around foreign bodies in the uterus. The first one, reported by Brignatelli, is not surprising, and is explained by the alteration of the uterine secretions under the influence of the irritation; but the details concerning this curious incrustation are wanting. In the second case, the foreign body was situated in the cervical portion.

Observation.—Piece of a reed in the uterus.—A woman, while resorting to secret practices, broke a piece of a reed in the uterus. No symptoms developed at first, but violent pains appeared at the following menstrual epoch; they resembled labor-pains. The uterus was increased in size; this could be readily determined by the aid of the vaginal touch and abdominal palpation. The orifice of the neck of the uterus appeared to be closed. The neck was hypertrophied as in pregnancy of the second or third month. Careful, methodical and repeated examinations showed, in the centre of the neck, a very slight projection, which presented great consistence.

The surgeon introduced the speculum, removed the mucus with forceps and charpie, but nothing came into view. Upon raising the anterior lip of the os tincæ with a grooved director, a foreign body was noticed which hardly showed itself outside of the cavity in which it was enclosed. Extraction was made with a flat-toothed forceps by producing rotatory movements. The body slipped twice, but the third attempt proved successful. Black, tarry clots of blood, like lees of wine, then escaped. Recovery.

The body was a reed, three centimetres long. Its external surface was found incrusted with very hard calculous matter. (Journ. de méd. et de chir. prat., T. XIV., 1848, p. 70.)

From the fact that I have been able to find, in medical literature, only one case of death from a foreign body in the uterus, we must not conclude that this termination is entirely wanting. On the contrary, it is probable that, in many accidents of this kind, it has occurred from peritonitis, perforation, metritis or purulent infection, and that the cause of death has been attributed to these affections. In Meschede's case, death slowly occurred from marasmus, after inflammatory symptoms.[1]

Observation.—Hair-pin in the uterine cavity.—Widow Z ——, aged forty-one years, entered the hospital at Swetz. Upon admission, general weakness, hystero-epilepsy, chronic rheumatism. Contracture of the leg on the thigh, spinal pains, tenesmus.

[1] Fr. Meschede: Deutsche Klin., 32, 1873.

Prolapsus uteri reducible in the beginning, then irreducible in consequence of painful spasms of the organ.

Formation of an abscess around the anus; fistula operated successfully; dysentery; death. The only data given concerning the autopsy are with regard to the peculiarity of the uterus, which contained an ordinary hair-pin; it was roughened and eroded in places. The chronic inflammation of the uterine mucous membrane proved that the pin had been situated in the cavity for a long time. The author attributes the contractions of the organ and the general convulsive phenomena to this foreign body.

In order that perforation should not be immediately followed by disastrous accidents, it is necessary that it occurs slowly at some part of the organ which is not covered by peritoneum—that is to say, at a portion of the fundus. The perforation has occurred three times in nine cases, and always with the same termination—that is to say, the formation of a purulent collection or phlegmon of the pelvis.

In only one case was the pus directed toward the iliac fossa and groin, while in the other it had been directed toward the cellular tissue of the ischio-rectal and thigh. I will report in full these two curious cases in which we find grave symptoms followed by a successful termination. In one case only thirty-five days had elapsed since the accident when the foreign body was extracted from the groin; in the other the catheter had remained in the pelvis for twenty months.

Observation.—Abortion produced by the introduction of a seton-needle into the uterus. —Escape at the groin.—Crouzit was called to a young girl in whose uterus a seton-needle had been introduced for criminal purposes. When he arrived the fœtus had been expelled; it was about three months old, and had been wounded by the instrument. But the latter, as well as the afterbirth, had not been removed. Examination did not reveal the place in which the needle was fixed; it was even impossible to extract the placenta on account of the constriction of the neck of the uterus, which was irritated by the manipulations to which it had been subjected. The surgeon thought that he could feel the needle on abdominal palpation. The placenta was expelled at the end of two days, and the patient had very grave symptoms. Eleven days afterward she began to feel pain in the inguinal region, in which an elevation formed on the thirty-fifth day; the pains became very intense. The needle then gradually approached and appeared on the seventy-ninth day. It was six inches long. Recovery. (Arch. gén. de méd., 1re série, T. III., 1823.)

Observation.—Case of recovery after extraction of a foreign body buried in the female pelvis.—Detention for twenty months.—A young woman, thinking herself pregnant, consulted an abortionist, who, it is supposed, attempted to introduce an elastic catheter into the uterus. The patient, finding that the catheter slipped out when she went to stool, endeavored to push it up farther, whereupon it disappeared to the great fear of the abortionist. Two or three months later the patient complained of great pain in the left hip, thigh, and leg. This gradually subsided, and the symptoms did not grow worse even when a large abscess formed near the left hip. A sound being introduced through a fistula, which was directed toward the tuberosity of the ischium, led to the side of the rectum. It did not communicate with the abscess, which had opened, and at the bottom of which the foreign body was not found. Upon examining the vagina with the finger, a transverse bar was discovered, which could also be felt in the rectum, and which was extracted through the latter by means of forceps, from a pouch extending to the lateral walls of the pelvis. It was an elastic catheter. The catheter, in passing into the cervix, had been pushed through the posterior wall, and in the next manipulation had been pushed still farther. Hence a phlegmon of the pelvis and perimetritis, giving rise to the abscesses of the hip and perineum. (The Lancet, Oct. 31, 1874.)

The bladder, which has not been the seat of perforations, possesses, perhaps, a certain immunity, and this is very naturally explained by the antero-posterior direction of the foreign bodies introduced, which tend to be directed toward the rectum rather than anteriorly.

Unfortunately, the phenomena produced by uterine foreign bodies are so vague and ill-defined that their diagnosis is difficult, if we are not aided by the confessions of the patients. All the primary or secondary symptoms are very natural after simple abortion, and a foreign body is not needed to explain their presence. It is only by investigating the condition of the parts by means of sight and touch, by carefully exploring the entire pelvis, that we can discover the foreign body, as was done in Maisonneuve's case. The diagnosis is even difficult when the confessions of the patient draw attention to the uterus. We must also inquire as to the position occupied by the body, and its situation, data which can only be obtained after a minute examination.

After they have been discovered, foreign bodies of the uterus should be extracted if they are still contained in the organ. From Lisfranc and Maisonneuve's cases of extraction we may judge of the difficulty which such a grave operation sometimes presents, and which threatened the life of the patient in the relatively simple case of the former surgeon.

Observation.—Piece of a rubber catheter in the uterus.—I was called to a woman, who, for illicit purposes, had introduced a large elastic catheter into the neck of the uterus; it had broken five centimetres from the end, and this piece had entered the organ. Symptoms of metritis were already manifest; I asked for the instrument which had been used, and found that it was not intact. I introduced a speculum and carefully cleansed the neck of the uterus, but could see nothing; I then slipped a straight catheter into the dilated internal orifice. It had hardly entered a distance of a few millimetres before I distinctly detected the presence of the foreign body, which was removed with forceps. The extraction was very painful, and a few drops of blood escaped. The inflammation extended to the peritoneum and was arrested by mercurial inunctions. No symptom of pregnancy was manifested. The patient, who thought herself in the third month of pregnancy, showed nothing which led me to suspect the presence of a fœtus. (Lisfranc: Clin. de la Pitié, T. II., p. 537.)

The fruitless attempt at section which Maisonneuve made, in order to remove a large piece of wood, would have been useful if the shears or forceps had been introduced higher up and sufficiently opened in the neck of the uterus in order to cut the foreign body, especially if it were placed transversely. In cases of necessity, on account of the swelling of the neck and the impossibility of acting with instruments, we must not be afraid to incise the neck laterally from within outward.

When the foreign body has left the uterus, we must be very cautious and not practise extraction if we run the risk of involving the peritoneum or of producing a phlegmon of the pelvis, the progress of which it will be impossible to arrest. It is better to wait until a tumor has formed in some locality, the groin or perineum, and then open it. Examination of this part will always lead, after a longer or shorter period, to the discovery of the foreign body, which it is necessary to extract with great care, cutting it if one end does not present spontaneously.

FOREIGN BODIES OF THE FEMALE URETHRA AND BLADDER.

CHAPTER I.

ETIOLOGICAL CONSIDERATIONS.

With the study of foreign bodies of the female urethra and bladder, we enter almost entirely into the domain of the results of masturbation and lewdness. More than nine-tenths of the cases belong, in fact, to this category, and are observed in females varying from fourteen to thirty years of age, and addicted to the solitary vice. The examples of foreign bodies introduced into the urethra, beyond the age of forty years, are very rare. Nevertheless, Cusco has extracted, at the Hôtel-Dieu, a bougie of white wax, carefully rounded at one end, from the bladder of a woman fifty-two years of age. It was incrusted at one end and had remained in the bladder for five weeks. The extraction was readily performed through the urethra, which was naturally very much dilated. The therapeutic etiology, which is so important when it refers to foreign bodies of the male urethra, is almost entirely absent in woman, because, on account of its dimensions, its breadth, and much shorter length, this canal is less subject to pathological affections. It is only under exceptional circumstances (before or after operations, during confinement), that it becomes necessary to leave catheters *à demeure* in the bladder, and the properties of the urethra explain the facility with which they fall into this organ. Finally, I must add to this group of causes the malice which probably accounts for the presence of foreign bodies, like needles, in very young children of the ages of two, three, or four years. Insanity also plays some part, and we must perhaps call upon this cause in order to account for the abnormal relapses of the introduction of foreign bodies which have nothing in common with those employed by masturbators in procuring the artificial sensations of pleasure. Thus, Cruveilhier reports that a woman had been cut for a pebble which she had introduced into the bladder through the urethral canal. Some time afterward it became necessary to remove, by hypogastric cystotomy, a second pebble, larger than the first. The patient died in consequence of the operation. The lunatic under Sonnie-Moret's observation, to whom reference has been made so frequently, had also, in a suicidal attempt, pushed a small package of cut iron wires into the urethra.

Observation.—Desault, says Maunoir, cut a woman for the third or fourth time, who had introduced into the urethra small stones which had grown larger with time; the imposition was finally discovered. This woman had thereby excited great interest and had received numerous gifts. (Thèse de concours: Montpellier, 1812.)

Apart from these various sources by which foreign bodies enter from without, there is another which is peculiar to women and results from the proximity of the uterus. Among the large number of foreign bodies of the bladder are found pieces of bone, debris of fœtuses, or misshapen bony masses, hairs, etc., which are due to the rupture of a dermoid cyst of ovarian or uterine origin into the bladder. In order to be complete, we must also add to these causes the accidental communications between the intestines and the bladder, injuries, etc.

CHAPTER II.

NATURE OF THE FOREIGN BODIES.

The habits of women and their sedentary pursuits explain why the majority of the bodies which have been extracted from their urinary organs are objects which they usually employ in the toilette or in their work. While the list in man is much more varied, it remains more uniform in woman, with this slight difference, however, that the objects are somewhat larger than those used by men. The type of foreign bodies in him would be, for example, a pencil, the twig of a plant, and that in woman would be a needle-case. The somewhat different dimensions of the canals will sufficiently account for these slight differences. In order to convince ourselves, it will suffice to glance over the following table.

Foreign bodies of the female urinary organs.	Foreign bodies which have come from without through the natural passages.	Of therapeutic origin.	Various female catheters.
		Of erotic origin.	Etui, ivory whistle.
			Hair-pins.
			Ear-picks.
			Ordinary pins, stick of sealing-wax.
			Needles, rye-straw.
			Bodkin, wax candle.
			Pencils, pen-holders, small ivory spindle.
			Pieces of wood, etc.
			Handle of mustard-pot, etc.
			Handle of tooth-brush, fork, etc.
			Lady's stiletto.
		Of various origins.	Pins.
			Package of iron wire.
			Pebbles.
			Pieces of brick.
	Foreign bodies which have come from without through accidental passages.	Abnormal communications with the uterus, intestines or pathological products; injuries: bone, hair, bullets, fruit-pits, etc.	

All these foreign bodies, especially those which have been introduced for erotic purposes, are characterized by the predominance of one diameter over the other. Almost all of them are long, somewhat large, regular,

smooth, and have polished surfaces in order to avoid all lesion of the organs. We never find any which are very large, while the small and ovoid bodies result, in the majority of cases, from accidental communications between the bladder and adjacent organs, such as misshapen bone or fœtal debris. The first will be the object of special study, while the latter only concerns the subject indirectly. Moreover, they present the same symptoms and methods of treatment.

In a general way, their length is not very considerable, and they differ in this respect from those in the male canal. The longest ones are pencils ten or twelve centimetres in length, ivory needles, pieces of wood, etc., in the group of erotic origin. Female catheters do not measure less than ten or twelve centimetres, and several examples of this kind have been observed.

There are very great differences among them with regard to shape and regularity, but the end which is first introduced into the canal is always blunt or polished. Certain metallic pen-holders indicate this type very well. Some are pointed at one end, and we are unable to explain this precaution in any other manner than that it is intended for the purpose of producing greater irritation. Moreover, and these cases are not very rare, certain girls attach a wire, the use of which it is not difficult to determine, to the middle or to one end of the object of their passion. Thus, Steel withdrew from a woman's bladder an ivory etui with a wire tied around its centre.[1] A young mother used a pointed stick attached to a wire, etc. This arrangement has been noticed in some foreign bodies in males, and I believe that we must regard it as the effect of precaution or of fear, or perhaps of a previous experience.

The most irregular foreign bodies are undoubtedly double hair-pins which, being introduced by the convex portion, pass entirely into the canal or into the bladder. They present two very dangerous irritating points, which may be embedded in any place and add greatly to the development of serious complications. Ordinary needles present the same characteristics to a less extent.

Among the numerous considerations to which the study of the properties of these foreign bodies gives rise, we must also add their flexibility or rigidity, which are especially interesting from a therapeutic point of view. Some, in fact, can be readily bent, like pins ; others will break immediately, like needles or sealing-wax ; others, finally, will resist any force on account of their rigidity (iron, ivory). Those which are made of wood, like pencils, or are of vegetable origin (stems of plants, straw), may be readily cut ; hence the notion of a peculiar mode of treatment which has been adopted by some surgeons.

It is very rare to find multiple foreign bodies, and these cases refer almost entirely to objects introduced into the bladder in consequence of an abnormal communication ; such are the bones derived from a fœtus, the teeth from a dermoid cyst, locks of hair, etc.

Almost all the cases of multiple introduction betoken a perversion of ideas. There is a very curious specimen in New York, representing a collection of 67 pieces of brick, which were extracted on several occasions from the bladder of a negress, who was accustomed to introduce them into her urethra, after having oiled them, for purposes of simulation. Their weight varied from a drachm to half an ounce.

A few years ago an analogous case, but which referred to gravel, was observed in the Paris hospitals.

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[1] Guy's Hospital Rep., 1853, p. 316.

CHAPTER III.

SITUATION.—MOBILITY.—FIXATION.

All parts of the urethral canal and bladder may be the site of the foreign bodies; sometimes they are situated in the canal, sometimes in the urethra and bladder at the same time, and finally, they may be entirely in the latter cavity.

There are no very satisfactory reasons in explanation of these various positions, which may moreover follow one another, and hair-pins have been known to fall into the bladder, despite their irregularities, as well as a piece of wood or an etui. Nevertheless, some long bodies do not readily enter, at least in the beginning, and remain engaged in the neck for a certain length of time. It is more rare to find one end projecting outside the urinary meatus.

As in man, foreign bodies which have fallen into the bladder may occupy the most variable positions, according to their shape, length, density, and irregularities. Those which are heavy, regular, and not large, occupy by preference the lower part; while some, which are lighter than urine, float on its surface. Certain fruit-stones, beans, cork, and pieces of wood, act in this manner. When the bodies are long and rigid, they assume the most varied positions in the bladder, are placed transversely (Delens, Nélaton), obliquely (Marjolin), or are buttressed by their two ends against the walls of the bladder, which they keep apart. A pencil composed of two parts was divided in the bladder, and the two pieces were placed obliquely crossing one another.[1]

In such cases it is rare that one end is not somewhat embedded in the wall, under the influence of the vesical contractions which, taking a point of support upon the rigid and pointed body, perforate the mucous membrane and fix the body in a definite position. Metallic and pointed bodies, like pins and needles, often present this arrangement, and the implantation may take place in all parts of the bladder, in the upper as well as in the lower segments. In a young girl who was operated upon by Guyon, a twisted and warped hair-pin was fixed into the upper wall of the bladder. This was also true of a girl operated on by Billroth, whose observation I report.

Observation.—Hair-pin in the bladder.—A girl, aged eighteen years, had suffered for a week from pains in the vesical region; the urine was sanguinolent at times, cloudy in the last few days, and left a thick sediment. The patient confessed that she had been addicted to manipulations of her genitals with the rounded end of a hair-pin. The pin had slipped from her hand and had probably entered the bladder. With a probe-pointed bistoury Billroth dilated one side of the urethral canal so as to introduce the little finger of the left hand. With his hooked finger he pushed forward the blunt extremity of the pin, which was fastened obliquely into the upper wall of the bladder, and performed extraction with the aid of forceps. No incontinence of urine followed, and three days later the latter was clear. The pin had already begun to be incrusted. (Schmidt's Jahrbücher, T. CXX., p. 209.)

"Swallowing" of Foreign Bodies.—As in man, so also in woman, there is a peculiar physiological phenomenon which tends to make bodies

[1] Bull. de la Soc. de chir., 1865.

that have been introduced into the urethra pass into the bladder. The mechanism is more obscure in the latter, and, on account of the shortness of the canal, is much more rapid. This is proven by authentic examples, such as that of Chapman, quoted in the works of A. Cooper, in which a metallic female catheter had glided into the bladder, during the few seconds which the operator consumed in taking a basin which he had placed on an adjacent table. This is not the only illustration of such a rapid disappearance, which cannot be explained, as in man, by retraction after erection. We must of necessity admit that a sudden contraction of the canal carries the foreign body inward, and makes it pass into the bladder. But such an explanation will not suffice to account for the phenomenon, and we can merely note the fact without explaining the reason. Moreover, this progression presents some peculiarities in woman. It is not always continuous, and it is not rare to find bodies, which have been left in the urethra, project into the neck and bladder, but not penetrate any farther. On the other hand, hair-pins, the progression of which in one direction is very readily explained, pass almost immediately into the bladder.

CHAPTER IV.

PRIMARY ACCIDENTS.

The primary accidents appear at extremely variable periods after the introduction of the foreign body, according to its situation, shape, length, and irregularities.

Those which are small and blunt only produce trifling symptoms, and the patients are not much disturbed if they are situated in the bladder. This is not so when they remain in the urethra, because they then produce considerable disturbance in the passage of urine, which is so much greater, as the irritation due to the presence of the foreign body causes swelling of the canal. The meatus itself takes part in this tumefaction.

Observation.—Hair-pin in the urethra.—Various symptoms.—A young domestic, fourteen years old, experienced intense pain in the genital organs (January 27, 1875). Retention of urine; general symptoms; very painful tenesmus. On the 4th a midwife made an examination, but found nothing. On the 5th the patient took to bed, and could retain the recumbent position only at the cost of violent pain. The general symptoms persisted; the bladder distended. The patient then referred to the loss of a hair-pin, a circumstance which coincided with the beginning of the symptoms. Examination revealed a sacculated dilatation of the anterior wall of the vagina; the orifice of the urethra was inflamed and painful to the touch. A foreign body was felt to be lodged in the canal, and could not be removed with the fingers. The forceps permitted the removal of a hair-pin 0.065m. long. The patient being unable to urinate, catheterism was resorted to. Improvement during the night; disappearance of the general symptoms. On the following day the patient rose from bed and urinated with facility. (Wien. med. Presse, 6, 1876.)

The mechanical discomfort experienced in the emission of urine produces functional disorders, which are evinced by pain, retention, or even incontinence. The pain is sometimes extreme, and results much more from the abnormal distention of the bladder by the accumulation of the fluid than from the local irritation. It has also happened that the physician in attendance was able to measure an enormous quantity of urine contained in the bladder.

Krongold observed a case of this kind. A hair-pin, which was contained in the urethra, produced excruciating pains in the abdomen and bladder, and very marked disturbances of micturition; the meatus was swollen. The extraction of the foreign body was made with the aid of forceps, and the use of the catheter permitted two and three-quarters litres of urine to escape.

But the retention is not always complete, and the patients may, for a certain length of time, expel a little urine at the cost of unusual efforts and great pain. The power of the bladder gradually diminishes, and the fluid, continuing to accumulate, finally escapes, drop by drop, from overflow. Retention is followed by incontinence on account of the same affection, and from a similar mechanism.

When the foreign body is entirely within the bladder, the mechanical phenomena are much rarer and give place to symptoms of cystitis. The desire to urinate appears very frequently and is unavailing, or terminates, perhaps, in the escape of a small quantity of urine, which is sometimes slightly sanguinolent, but not yet cloudy. It is especially toward the end of micturition that the pains appear, and are reproduced at the same time that the patient experiences an incessant desire.

To what are the pains and cystitis due? Undoubtedly to the irritation of the mucous membrane produced by the irregularities of the foreign body, which becomes so much more irritant because the bladder, toward the close of micturition, contracts more strongly upon the object. In some cases the patients experience acute, cutting pains upon walking or impressing the least movement to the pelvis.

Finally, the retention of urine, when the foreign body is situated in the urethral canal, may produce intense reaction. In one case, in which an etui produced a mechanical retention and incontinence with overflow, insomnia occurred, with fever, and a grave, adynamic condition.

In conclusion, the initial symptoms are not very grave, unless there is retention, in which case horrible pains force the patients to seek assistance. If the foreign body is situated in the bladder, and is less irritating, it will be tolerated for a long time, and will not attract attention except after the development of secondary accidents.

CHAPTER V.

SECONDARY PHENOMENA.—TERMINATIONS.—COMPLICATIONS.

Incrustation.—Formation of Calculi.—The majority of the foreign bodies which are present in the female bladder or urethra become covered, after a little while, with calcareous incrustations, the successive and slow deposit of which terminate in the formation of nucleated calculi.

The mechanism by which these concretions are produced is in all respects the same as that in foreign bodies of the male urinary organs, and I would merely refer to what has been said on that subject, except to call attention to some slight differences in the shape and development of these calculi. Thus, ovoid concretions are very rare because the majority of the foreign bodies are long, and the deposits form by preference in the middle of the body, especially if the two ends rest against the walls or par-

tially traverse them. Almost all of them belong to the fusiform type, and are penetrated by the needle, pen-holder, etc. The representation of a few specimens of this kind will convey a correct idea of their shape and size. They sometimes present a very curious arrangement, which is equally well marked in calculi without a nucleus. I refer to a circular depression which corresponds to the point where the neck of the bladder presses on the calculus, when the foreign body is partially within the urethra. This arrangement was present in a case observed by Passaquay.

The fusiform calculi may attain a very considerable size. Patissier[1] withdrew, from the urethra of a woman fifty years old, a calculus weigh-

Fig. 72.—Calculus formed at the end of a pencil which had remained in the female bladder for a long time. (Bull. de thér., 1855, p. 261.)

ing more than an ounce, formed in the canal around a double pin which had been introduced three years previously. In another case reported by Jobert, a pencil had entered the bladder, and an enormous calculus had formed at one end, while the other, which was free, had perforated the bladder and vagina. The foreign body was no less than nine centimetres long. A girl, whose history is reported in Hybord's thesis, had in her bladder, for a long time, a hair-pin, which finally became calculous. At the period of its removal the two pointed ends of the double needle alone projected beyond the calculous mass, like the two horns of a snail. On ac-

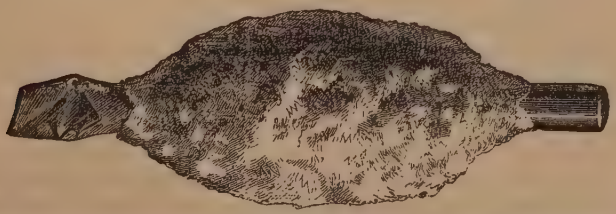

Fig. 73.—Fusiform calculus formed around a metallic pen-holder (after Bouisson).

count of their shortness, the examples of bent foreign bodies are much rarer in females than in males. But, nevertheless, there are some which develop upon hairs derived from dermoid cysts that have emptied into the bladder and which have become the nuclei of calculi.

The fusiform shape, like that of the calculus removed by Bouisson

[1] Dict. des sciences médicales.

(Fig. 73), is the most common; we also find the club-shaped arrangement, especially when the bladder has been perforated by one end of the body.

Observation.—Fusiform calculus around an ivory needle.—The Leipzig Transactions (1700) contain the history of an ivory needle which had been introduced into the female bladder. One end had gradually perforated the walls and had produced an abnormal projection in the hypogastrium under the abdominal walls. Supra-pubic section was performed nine weeks after its introduction, and a club shaped vesical calculus was removed; the other end was smooth and polished.

Both ends of a piece of straw removed from a woman's bladder were found covered with calculous concretions. When the calculus has become somewhat larger, we very frequently find that other small secondary concretions also form, which remain for a longer or shorter period, or are expelled by the bladder shortly after their formation. These phenomena were present in the case of a calculous piece of wood, the history of which is found in Hybord's thesis.

Moreover, a girl twenty years old, who had a nucleated calculus in the bladder, has been known to pass a secondary calculus weighing 2.80 gr., followed by a third one weighing 4.50 gr. In a woman whose bladder contained a wooden etui, several small calculi, some of which were as large as a hazel-nut, were found, in addition to the incrusted foreign body. They usually occupy the cavity of the bladder itself, but, like those in the male bladder, they may be concealed in an accessory pouch which the foreign body has hollowed out for itself in the wall, or perhaps in a cavity formed at the expense of the interstices of the columns. This arrangement was especially observed in a girl nineteen years old, who had an iron needle in the bladder, and whose history will be reported in the remarks on treatment.[1]

Hitherto I have intentionally omitted speaking of the time necessary for the formation of these calculi; there are very great variations in this respect. Sometimes the calculus has only arrived at its maximum development after the lapse of several years, while in other cases abundant deposits have been noticed a few days after the introduction of the foreign body.

Finally, the composition of these concretions is almost the same as that of vesical calculi in man. The following is the composition of one which had formed around the handle of a tooth-brush introduced into the bladder:[2] urate of ammonia, xanthine, phosphate of lime, ammonio-magnesian phosphate.

Symptoms of Calculi formed around Foreign Bodies.—In the beginning the symptoms of the calculi are often masked by other accidents, which are the consequence of the prolonged irritation or wounds of the walls. All these causes unite, in fact, to produce very painful cystitis, with frequent desire to urinate, oozing of sanguinolent urine, sometimes even hemorrhage, as in Marjolin's case.[3] The sufferings produced by the contact of the foreign body with the inflamed bladder are sometimes so great that the patients make outcries and assume the most singular positions. One woman observed by Monteil de Mende, and whose history is reported by Foucher, had half of a paper of needles in her bladder; she was unable to lie in bed except with the lower limbs flexed on the

[1] Acad. des Sciences de Paris, 1878, Obs. 5.
[2] The Lancet, 1874.
[3] Soc. de chir., 1865.

abdomen, or seated as if crouched on the ground. When such serious symptoms appear, those which mark the beginning of the incrustation are obscure. But if the tolerance is very great, we can better observe the lithic formation, which is always manifested by abnormal pricking and tingling in the region of the urinary meatus, by more frequent desire to urinate, dull pains during micturition, and especially slightly cloudy urine at the outset, which then becomes slightly ammoniacal, decomposes very rapidly, and after a little while leaves at the bottom of the vessel a thick layer of calcareous salts mixed with pus or muco-pus produced in consequence of the cystitis. During this time, the general condition is still but little affected; it only begins to feel the effects of the local affection during the final period. In proportion as the calculus increases in size, the symptoms become aggravated and the pains become more severe, the urine escapes guttatim, the stream is sometimes intermittent, and may be suddenly suppressed.

The points of the foreign body produce acute pain after each act of micturition. The following case reported by Richet is a very characteristic example:

Observation.—Vesical calculus formed around a hair-pin in a woman twenty-two years old.—Urethral section by Dubois.—Secondary incontinence of urine.—Recovery.—"A seamstress, æt. twenty-two years, entered la Pitié, on May 20, 1868, for an uterine affection. On exploration of the bladder, the sound discovered a calculus.

The patient was chlorotic, menses had always been regular; three years previously she had had a child, and since her confinement had experienced acute pains in the kidneys and abdomen. Six months previously she noticed that she was urinating blood, sometimes pure, sometimes mixed with urine; at the same time the pains increased, but they were never so acute as when the patient had walked a little, and especially when she rode in a carriage. Since that time she urinated five or six times a day, and each act of micturition was accompanied by the most intense sufferings. Finally, she noticed that the stream of urine was often arrested suddenly, and then reappeared a few seconds later.

Fig. 74.—Calculus formed around a hair-pin, the ends of which are visible.

Vaginal examination showed a very large, round, hard projection, which depressed the anterior wall of the vagina toward the fundus of the bladder; upon moving it slightly with the finger, the projection was found to be movable and independent of the vesical walls. The instrument gave a dry, sonorous sound. Richet found the following dimensions with the lithotrite: 0.035 m. to 0.040 m. in one direction, and 0.030 m. in another. The calculus was consequently ellipsoid and slightly flattened upon its surfaces. Irritable bladder; the urine, which was clear at the beginning of micturition, contained, at the close of the act, a certain amount of mucus, and even of muco-pus, indicating a very serious inflammation of the mucous membrane of the bladder. The patient gave no positive data concerning the origin of the affection.

Operation performed June 4th; anæsthesia. After having introduced a grooved director into the bladder, Richet introduced upon it Frère Côme's simple lithotome; being certain that it had passed the neck of the bladder, he removed it by bending the handle toward the anus. It was arrested at number 55. Escape of urine and blood. Richet introduced his finger, and upon it a pair of forceps, with which he grasped and removed the calculus; this was not done without some difficulty. This calculus appeared in the shape of an ellipsoid, the larger extremity of which presented a circumference of 0.050 m.; the smaller was 0.025 m. and was surmounted by two points formed by the ends of a hair-pin. Upon section, the calcareous concretion was found to be deposited around the foreign body in the form of concentric layers. The chemical analysis showed that it was composed of phosphate of lime; the weight was 42 grammes.

The after-effects were not very simple, on account of an incontinence of urine which continued for six months. At the end of this time she left the hospital entirely recovered, being able to retain her urine. (Thèse d'Hybord : Paris, 1872.)

The initial symptoms continue; rapid emaciation, loss of energy, continual insomnia, incessant desire to urinate, are superadded. The ammoniacal urine irritates the genito-urinary organs and the thighs, and, when it is passed in considerable quantity, it is earthy and purulent.

Disorders of menstruation, which are hardly ever absent in any cases, appear from the beginning. Dysmenorrhœa, lasting for several months, is followed by almost complete amenorrhœa, acute pain, and periodical colic.

Finally, a condition of marasmus develops with genito-urinary and the most grave general complications, such as cystitis, more rarely nephritis or pyelo-nephritis, fever, chills, an adynamic condition, peritonitis, and death. However, these affections, whose issue is almost always fatal in these cases in man, are somewhat less disastrous in woman; and, as we shall see in the following paragraph, more than one way is left open to the foreign bodies to leave the bladder, even after they have become nucleated calculi.

By the side of these secondary accidents we must also place the cases of prolonged retention which terminate in incontinence of urine from overflow, but none the less produce very severe internal disorders—hæmaturia, nephritis, uræmic symptoms, and, as in a very curious case reported by Commandré[1], an eruption of urticaria.

Observation.—Needle-case introduced into the urethra, and successfully removed after being present in this canal for a month.—During the month of June last, a girl, aged twenty-three years, of a strong constitution, presented herself in my office, and, without any circumlocution, asked me to remove a needle-case which she had introduced into the urethral canal.

Fig. 75.—An etui which had fallen into a woman's bladder and became the centre of a calculus. (Dupuytren's Museum.)

The foreign body was situated very deeply. The eye could distinguish nothing at the external orifice, which was of a bright red color, as in urethritis; but the finger being introduced into the vagina enabled me to feel the object along the whole length of the canal, which was very sensitive, especially in its deeper parts toward the neck of the bladder.

The patient stated that the etui had been in this situation for forty days, the time at which she had begun rearing silk-worms in the country. All her efforts to remove it, which she had made a thousand times, were fruitless. During this long month, she had suffered from constant insomnia and incessant desire to urinate, with great pain during micturition.

There was, in fact, mechanical retention of urine from the presence of the foreign body, which closed the canal throughout its entire extent. The urine only escaped from overflow, or after unusual effort. An eruption of urticaria covered the entire body and produced intolerable pruritus, which caused the patient at least as much torment as that produced by the foreign body. In the midst of all these sufferings the unfortunate girl was doing work of the most fatiguing kind for her sex. She gathered the leaves of the mulberry, passed the nights in tending to the worms, and in fact performed work which tries even those in the best of health.

I have said that the finger, on being introduced into the vagina, enabled me to distinctly determine the presence and position of the object in the canal; but all the

[1] Bull. de thér., 1867, p. 369.

manipulations made in this way, in order to extract it, did not succeed in producing any displacement. The canal, which had been excessively distended, appeared to have formed adhesions with the needle-case, and accompanied it in all the movements which I endeavored to impress upon it.

A sound introduced into the canal came in contact with the object at about two centimetres from the orifice. The etui had been introduced by its base, and the cover had been removed. It was not difficult to pass one blade of a pair of forceps into the interior of the case, and the other externally, but now the difficulties began. The etui carried with it the canal, to which, as I have stated, it was adherent. I had no assistant, and was unable to obtain one. The patient begged me to operate upon her without assistance. Her brother was waiting at the door of my office, and she desired to conceal her condition from him.

Firmly grasping with the left hand the forceps which held the etui, I drew it forcibly upward and outward, while I pushed back the folds of the canal with the index finger and thumb of the right hand. The manipulation was very painful to the poor girl, who endured it bravely; but as soon as the end of the case appeared outside of the meatus, it appeared as if the interior of the canal was excoriated, and the etui escaped, accompanied by a stream of very fœtid, bloody urine.

The case was 0.070 m. long and 0.0175 m. in diameter. It was covered over its entire external surface, with the exception of about half a centimetre toward the base, by a saline concretion 0.002 m. to 0.003 m. in thickness, which was undoubtedly urate of lime. The interior was empty, and only presented a thin layer of white matter upon its walls. The lower end, which was not covered with a saline concretion, appeared to me to have been cleaned by the contractions of the neck of the bladder, in which it had been engaged.

This injurious action affects not only the urine, but it may also interfere with important functions—for example, parturition. The literature presents several cases of severe accidents produced by the disastrous coincidence of an incrusted foreign body in the bladder, and pregnancy. The following is one of the most interesting:

Observation by Ducasse.—Calculus formed around a pin in a pregnant woman.—Delivery.—Death.—A girl had introduced a large pin into her urethra. The foreign body soon entered the bladder, and, the pains being relieved, no surgeon was called. The girl had, in some sort, forgotten the circumstance, and soon after became enceinte. During pregnancy the pin became covered with salts and became the nucleus of a calculus which was sufficiently large to form an invincible obstacle to pregnancy, by constricting the antero-posterior diameter of the pelvis. The use of the forceps became necessary in order to extract the child, but the contusion of the organs during parturition was so great, and the walls of the uterus and bladder had been so severely injured, that abdominal inflammation followed the delivery, and gave rise to several foyers of suppuration, which rapidly caused death.

The autopsy revealed the cause of all these disturbances; an enormous calculus had formed in the bladder, the nucleus of which was formed of the pin which had been introduced. (Jour. de méd. et de chir. prat., 1843.)

This is not the only example of the coincidence of pregnancy and foreign bodies of the bladder. Nélaton's patient, whose history will be found in the chapter on treatment, died from the accidents following extraction.

Almost all the complications which develop during the presence of foreign bodies in the bladder are the result of wounds of the mucous membrane, made by the irregularities of the object. All those which are local are of a traumatic or inflammatory character, and terminate in the perforation of the bladder. This is a frequent complication in pointed bodies, which have been present for a long time, and it is consequently observed also in foreign bodies which have become nucleated calculi. The mechanism of the perforation is very different, according as it is effected by a very narrow and pointed body which is capable of readily passing, or by an irregular, blunt, and rigid object. In other words, needles do not perforate the bladder by the same mechanism as pencils, etuis, hair-pins, etc. The vesical contractions engage the first mentioned in the direction of

their points, and in this manner they may penetrate into the peritoneum or into the cellular tissue which surrounds the inferior and lateral portions of the bladder. Judging from the few cases of this kind which are reported in literature, the latter path is the most frequent; it is quite possible that more than one case of peritonitis has been the result of an unknown perforation. In two instances the foreign body has travelled outside of the bladder into the labium major.

Observation.—Needle in the bladder, which protrudes at the labium major.—Ruggeri preferred to leave a needle in the bladder, fearing that, if he performed cystotomy, the forceps would imbed the needle in the walls of the bladder. It is not uninteresting to know that, in this case, the needle projected soon after to the inside of the labium major, whence it was readily extracted without danger. (Gaz. méd., 1840.)

Observation.—Abscess of the labium major produced by a needle.—A little girl, aged 4 years, had presented since the age of two years all the symptoms of a calculus; at the outset she had had violent colic. An abscess formed at one of the labia majora, and a needle was extracted. (Med. Essays and Observ., T. IV., 16, p. 297.)

It is evident that whenever a calculous concretion has formed around a needle, the passage is not so readily effected as in Ruggeri's case. But perforation is not always followed by the passage of the foreign body, which may be retained in the bladder by one end that has become the nucleus of calcareous incrustation. As it is very difficult for such a movable and irritating point to remain outside of the bladder for a long time without producing accidents, inflammation develops in the peri-vesical cellular tissue, collections form and protrude at the abdomen, groins, perineum, or labia majora. The following is an illustration:

Observation.—Supra-pubic abscess.—Extraction of a nucleated calculus.—A needle, three inches long, became imbedded in the walls of a woman's bladder. In consequence of the incomplete perforation, an abscess formed above the pubis. After it had been opened, the orifice was dilated, and when the foreign body had been discovered and the opening in the bladder dilated, the calculus which had formed around the head of the needle was crushed and extracted. (Journ. de méd., T. L.)

The process varies when the foreign bodies are hard and blunt, like catheters and pencils, but the results are the same. I must remark, in the first place, that the foreign bodies have, on account of their situation, weight, and perhaps also on account of a natural tendency, a disposition to perforate the vesico-vaginal or urethro-vaginal wall, which is the weakest of all. In this respect we must consider simple and double perforations. Long and solid foreign bodies rest by their two ends against the walls, and produce a pressure which, when continued for a long time, terminates in local gangrene from compression, and secondarily in perforation.

As this phenomenon is produced very slowly, and as the peri-vesical cellular tissue has time to establish adhesions even before the perforation is complete, an abscess or phlegmon forms on each side, which may open in both groins and give rise to fistulæ, if the foreign body was situated transverse. A precisely similar case is found reported by Morgagni. It referred to a knitting-needle, which produced two abscesses in both groins, and later, two fistulæ.

If, on account of its shape, the foreign body cannot pass outside of the bladder, as in a tipped female catheter, the collection will be changed into an interminable fistula. This very curious result is well demonstrated

by the following illustration; in this case, however, the pus was carried toward the ischium and hip.

Observation.—Case of perforation by a female catheter which emerged at the buttock.—"A woman, twenty-five years old, complained of painful and involuntary evacuation of urine, which escaped from the urethra, together with blood and puriform matter. She also passed purulent urine from a fistulous ulcer which was situated in the buttock, about the middle of the gluteus major. She was in a condition of marasmus. Upon sounding her, Ford found a foreign body in the bladder. Upon examining the ulcer he learned from the woman that it contained a piece of detached bone, which often appeared outside of the skin, but seemed to be frequently withdrawn with considerable force. Ford discovered with a stylet that this body was free in the fistulous sinus and attempted to remove it. When the foreign body was withdrawn for half an inch, it was impossible to remove it any farther, as it was retained by a strong contraction of the muscles. Upon examining it more closely, Ford was astonished to find that the foreign body was evidently the blunt or closed end of a silver catheter. Upon being questioned, the patient stated that she had been attacked with great difficulty of micturition in the third month of her last pregnancy, and that this had been relieved on several occasions by the use of the catheter. A surgeon who lived in the vicinity was summoned, and had caused her very great pain by catheterizing her, and from that time she was unable to rise from her bed without experiencing great distress. The pregnancy went on to full term, and she nursed the child, although extremely feeble. It was evident that all the symptoms were due to the presence of the catheter, and when her strength had improved, Ford performed extraction through the urethra. He dilated the urethra, introduced forceps, but experienced some difficulty, because the handle of the instrument was at the pubis and the blunt end at the ischium. Upon pulling on the beak through the ulcer in the buttock, its direction was changed and the instrument could then be removed. The catheter was covered with a slight incrustation. The fistulous ulcer in the buttock healed in a few days, and recovery occurred within a month." (Med. Facts and Observ., V. I., p. 96, London, 1791.)

By the side of these curious cases must be placed the perforations of the vesico-vaginal wall, which are much more numerous, and which do not usually appear until a long time after introduction. This rule is not without exceptions, as is proven by the following case published in a Spanish journal:

Observation.—Two-pronged fork in the bladder.—Perforation of the vesico-vaginal septum.—Extraction.—Recovery.—A young girl, eleven years old, had introduced an instrument into the bladder, shaped like a two-pronged fork. Several physicians were called, among others Aravaca, who found the child suffering from pain in the bladder, especially during micturition. An examination enabled him to discover a metallic foreign body, which extended from right to left, and from above downward. The body could not be moved, and it was concluded that it had engaged in the walls of the bladder. A very viscid solution was injected, in order to dilate the bladder and allow the body to be seized, but these attempts failed. The vagina only admitted the little finger, and its exploration furnished no information.

During the following days the patient only suffered at the end of micturition, and the pains were accompanied by the escape of a few drops of blood. On the fifteenth day she experienced difficulty in moving, and felt a sensation of weight during micturition and defecation. On the twentieth day, the mother summoned the first physician and informed him that she had felt the fork. In fact, she seized one prong through the vagina, forcibly drew upon it and the other prong, and, after prolonged and vigorous tractions, the fork made its exit; further tractions expelled it altogether. The urine flowed through the vagina for a time, but it had resumed its natural course at the end of six days, and recovery occurred. (Aravaca: El siglo medico, 1865.)

In almost all the cases, the end which is incrusted with calcareous salts remains in the bladder while the other is found in the vagina. The perforation sometimes occurs at the neck of the bladder or urethra, but the mechanism of its formation is always the same, viz.: from the continuous pressure of the pointed extremity. The difference between this va-

riety and the preceding is that there is no abscess, and that the urinary fistula is established almost immediately..

Under the influence of the vesical contractions and the advance of the affection, the fistulous ulceration gradually enlarges, and the calculus partially engages in the vagina. Cases have been observed in which it has passed almost entirely into this organ.

Philips communicated to the London Obstetrical Society a case in which a pencil had been in the bladder of a girl, eighteen years of age, for six months, and one end of which had perforated the vagina. She had incontinence of urine for several months; the other end of the pencil was found in the bladder, covered with phosphatic concretions. In two cases reported by Morgagni and Zampollo, the needles succeeded in making their way outside by perforating the urethro-vaginal septum. In Jobert's case,[1] a pencil had also passed through the fundus of the bladder, for we cannot admit the traumatic etiology claimed by the young patient, who did not speak of her accident until six months afterward. One of the most curious cases of this kind is undoubtedly the one which is found quoted in Morand's treatise:

Observation.—Ivory needle in the bladder; escape through the vagina.—Urinary fistula.—"A girl of Parma, named Dominica, whose history and depraved habits are described by Morand (Obs. IX.), had introduced into the bladder an ivory-headed needle as long as the finger. Intense pains; she was only able to pass her urine guttatim. For five months the girl concealed her trouble; but finally, becoming emaciated and fever developing, she went to a surgeon, who, having introduced a finger into the vagina and felt a hard mass there, discovered the end of the needle with an instrument, removed the stony mass which surrounded it, and thought that he had made a good operation. But the symptoms continued, and another surgeon introduced a catheter into the bladder, which was ulcerated and torn on the side nearest to the vagina; he felt a hard body. He ordered a large amount of oil in order to relieve the acute pain. A few days afterward the stone, which had formed around the needle, appeared at the entrance to the vagina through the opening made in the bladder, and was extracted with the hand, without the aid of any instrument. Recovery, with the exception of persistent incontinence of urine, and very frequent inflammation of the parts."

I have intentionally omitted speaking hitherto of the perforations produced by bodies which, like hair-pins, are bent on themselves and present two points. They produce perforations much more quickly; they do not progress appreciably, because the two points are often separated and oppose their penetration. Thus, one point may be fixed in the anterior vesical wall, while the other is in the vagina. The importance and gravity of such an arrangement is evident with regard to treatment. In fact, if we exercise traction on one end of the needle, not only will we not succeed in removing the body, but we will bury the other branch still farther, and may thus cause very serious disorders. One case of this kind was observed by Spessa,[2] and Chopart mentions an analogous one.

Various Terminations.—It is useless to speak of the tolerance of the bladder, as it is only relative and does not last more than a few months. Complete tolerance has never been observed.

If foreign bodies of the bladder are not withdrawn by the surgeon, they can have no other termination than elimination by the unaided forces of nature, either through natural or artificial passages, or death within a longer or shorter period.

Spontaneous expulsion, although it is favored by the natural dimen-

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[1] Bull. de thérapeutique, 1855.

[2] Gaz. méd., 1840.

sions of the canal and its shortness, is not frequent, and examples of it must be regarded as curiosities. Sometimes it refers to bodies which have not undergone calcareous incrustation, sometimes to calculous bodies. In the latter case the exit occurs only after a truly difficult labor. However, the proportion of cases of expulsion is far greater in woman than in man. Thus, among 386 cases of foreign bodies collected by Denucé, spontaneous expulsion occurred in 37, which are apportioned as follows: males, 14; females, 23. When the foreign body is in the bladder, spontaneous expulsion includes two periods: in the first, the body engages in the canal; in the second, it is expelled. The first period is rarely spontaneous, and is the effect of pure chance when it is produced; but this is readily understood, as the usually long body is placed more or less obliquely or transversely, becomes fixed, etc. The majority of cases of expulsion refer to bodies which are situated in the urethral canal. A child, four years old, passed an oval stone weighing more than half an ounce; it was transfixed by a sewing-needle about one inch long, the ends of which passed a few lines beyond it.

Another illustration was communicated to the Surgical Society by Aubry. He had under his care a peasant-girl, twenty-two years old, who had introduced a piece of wood into the bladder. Several fruitless attempts were made to remove the foreign body, whose nature and origin were unknown. One day it appeared spontaneously at the meatus urinarius, and was readily extracted.[1]

As soon as they have engaged in the canal, they give rise to violent efforts of contraction on the part of the bladder, and if the force of the latter is not exhausted by long detention, they will be much more efficacious, as the canal in the female is dilatable. Benedetti has transmitted a very interesting observation of a woman who had a needle incrusted in the bladder, and who passed it one day through the urethra during efforts at defecation.

The elimination through artificial passages occurs by means of abscesses, which open more or less remotely in the groins, abdomen, labia majora, etc. I have reported some examples in the course of this work. We may also consider the very frequent perforation of the vagina as the first stage of natural elimination. The observation of the girl of Parma, referred to by Morand, is a true example of this type of expulsion.

If the body remains for an indefinite period, death occurs sooner or later, either in consequence of complications of the local condition, or on account of the hectic fever and marasmus. The most serious local affections are cystitis, pyelo-nephritis, nephritis, urinary infiltration, perivesical abscesses, gangrene, peritonitis, etc.

Death from general disturbances develop, as in man, in consequence of a peculiar cachexia. Morgagni[2] mentions several cases of death. In one of them death was caused by a bony needle incrusted with calcareous salts, and gangrene of the bladder was found on autopsy. Civiale has also mentioned a similar termination occurring in a woman who had an ivory needle in the bladder. She died from exhaustion, after terrible pains.[3]

This termination would be much more frequent, if art did not interfere to relieve the patients of the cause of their sufferings.

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[1] Bull. de la Soc. de chir., 1865. [2] De sedibus, Ep. 42, p. 25.
[3] Traité de l'affection calculeuse, p. 84.

CHAPTER VII.

DIAGNOSIS.

Here, as in man, two very distinct cases are presented: either the data concerning the origin of the foreign bodies are definite, or they are obscure or absent. It happens in rare cases that a mother, without waiting to be questioned, asks the physician to relieve her daughter of a foreign body which she has in the bladder. Morand cites a case of this kind. Rarer still are the women who frankly confess the occurrence, as the girl did, who, having reached the limit of her endurance, entreated the surgeon (while her brother was waiting at the door) to remove at once an etui which she had introduced some time previously while practising masturbation. In most cases the history only serves to mislead the physician. But he must take into consideration the concocted stories which the relatives and patients relate with inexhaustible prolixity.

As in man, we must accept everything, and must only regard two things, viz., the foreign body and the symptoms. All the rest is trivial. Moreover, the physician may, without fear of error, set aside the question of origin, which is almost always the same. At times the symptoms, nature of the pains and condition of the urine, put us on the track of the diagnosis, and enable us to discover the real and hidden origin of the symptoms.

We must then carefully explore the genito-urinary organs, palpate and percuss the abdomen, investigate the menstrual disturbances, practise vaginal and urethral touch, and, if necessary, rectal touch. When the finger enters the urethra with facility, there are many chances that the girl is addicted to mechanical masturbation. Finally, the surgeon must catheterize the patient, using a silver catheter. If the foreign body is metallic, it may transmit a metallic sound, as happened to Bouchacourt; in all cases the instrument gives the well-marked sensation of a foreign body. A vaginal examination and exploration of the bladder with the aid of a catheter, performed at the same time as abdominal palpation, may sometimes render good service.

The use of the sound is not always sufficient, and does not give such accurate data as the finger with regard to the situation, position, etc., of the foreign body. It is also advisable to explore the bladder with the index finger, if this is possible. In order to do this, preliminary dilatation is effected with the aid of an aural speculum (Passaquay, Monteil), or of the ring finger followed by the index finger.

By utilizing the great dilatability of the urethra we may very readily, especially in persons who have previously enlarged the canal by their manipulations, examine the bladder, recognize the position of the body, and base a rational and certain treatment on these valuable facts.

In conclusion, we must consider the clinical history when it is given, the account of the symptoms, and especially mediate and immediate exploration.

Nevertheless, mistakes are sometimes committed, but the patients cannot long impose on a surgeon who carefully examines the organs. The following observation is perhaps unique of its kind.

Observation.— Foreign bodies in the bladder.—Mistaken for pregnancy.—A young girl, seventeen years old, who had lost her courses since Feb. 8th, was admitted to "The Hospital for Women," as being enceinte, in the month of June. The general appearance was good, the abdomen more developed than usual in girls. The breasts were large, and the hard nipples were surrounded by a dark, well-marked areola, and strewn with hypertrophied follicles. The mammary gland did not contain any milk. Since the cessation of the menses, there had been incontinence of urine at certain times, and the latter was only passed in small quantities. At certain periods there were repeated attacks of vomiting. Urine cloudy, thick, alkaline, albuminous, and exhaling a very marked odor; sp. gr. 1035. The patient had never passed any gravel. Despite the above-mentioned signs of pregnancy, palpation and percussion showed that the uterus had not increased in size. The introduction of a catheter into the bladder enabled the physician to recognize the presence of a large calculus. The finger could be

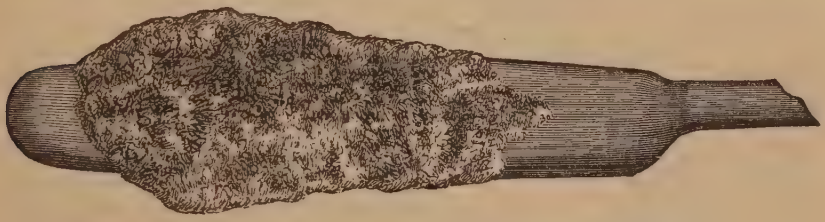

FIG. 76.—Handle of a tooth-brush, covered with calcareous deposits, found in a young girl's bladder. (The Lancet, 1874.)

introduced through the urethra into the bladder, whose firmly contracted walls prevented the mapping out of the calculus. The patient was anæsthetized with chloroform, the calculus was seized with a lithotrite, but only the superficial layers could be crushed. They surrounded a very hard foreign body, one end of which was engaged in a cul-de-sac which corresponded approximately to the inner third of Poupart's ligament. The foreign body could only be extracted through the urethra after considerable difficulty; it was the handle of a tooth-brush, a full-sized representation of which accompanies this observation (Fig. 76). The girl was at first unwilling to give any explanation, but she afterward pretended that she had on several occasions employed this instrument in order to relieve retention of urine, and that it had one day been carried into the bladder.

Everything went on well after the operation. The menses returned at the end of twenty-five days for the first time in seven months, and have been regular ever since.

The calculus contained urate of ammonia, xanthine, phosphate of lime, and ammonio-magnesian phosphate. (The Lancet, Jan. 24, 1874. Thomas Whitehead.)

CHAPTER VIII.

TREATMENT.

Two great methods include all the measures which have been employed in order to extract foreign bodies of the urethra and bladder. These are extractions through the natural and artificial passages. Thanks to the ready dilatation of the urethra and its shortness, the method of extraction through the natural passages continually tends to become generalized, and the indications for extraction by cystotomy are becoming more and more restricted. As a large number of the operations are almost the same as in man, I will merely indicate their mode of employment.

§ 1. Extraction through the Natural Passages.

After having carefully determined the position of the foreign body, it is necessary, before performing extraction, to make a certain number of indispensable preparatory manipulations, viz.: dilatation of the canal, displacement of the foreign body if it is fixed, injections, etc.

Fig. 77.—Dilator for the female urethra.

Dilatation is by far the most important, and, in fact, constitutes a special method. It is based upon the elasticity of the urethra, which allows itself to be readily dilated, either slowly or suddenly, until it easily permits the passage of even very large bodies. It is sufficient to recall the example of the woman observed by Mayer, in whom the urethra had become sufficiently large to permit coitus to be performed in this organ in the absence of the vagina. Dilatation applied to treatment of foreign bodies in the female bladder had been employed in France in 1675; Molinetti employed it in order to extract a needle made of bone; Lachèze, in 1751, to remove an ear-pick. More recently it has been extolled and perfected by Tolet, A. Cooper, and, at the present time, dilatation counts numerous partisans, among whom Bryant in England is one of the most zealous.

There are two ways of performing dilatation of the urethra—either slowly or suddenly. Both have their own indications according to circumstances, but the majority appear, at the present time, to give the preference to slow dilatation. When we wish to employ it, we introduce into

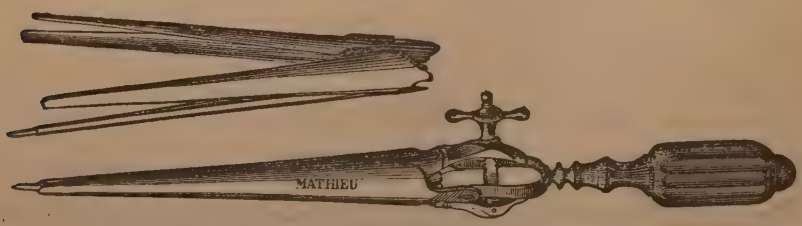

Fig. 78.—Mathieu's urethral dilator, with four blades.

the meatus some prepared sponge, a laminaria-tent, gentian root, or we can make a successive dilatation by means of larger and larger sounds.

Rapid dilatation is obtained by the aid of instruments or of the finger. The instruments which are preferably employed are various specula, especially nasal, oral, and anal, and dilators of all kinds. Dolbeau's dilator undoubtedly renders great service, but dilatation cannot be pushed be-

yond three centimetres. Weiss' dilating forceps (three-pronged Weiss' forceps) are employed a great deal in England. In Germany and abroad, Simon's (of Heidelberg) graduated dilator, which permits a dilatation of 0.02 m., is used for this purpose. In America this method is very frequently employed. Jewett obtained, by the mere introduction of the finger,[1] a rupture of the vesical orifice, which enabled him to extract a crochet-needle deeply embedded in the vesical walls of a girl fifteen years old.

The finger is almost always sufficient, especially if we begin by introducing the little finger, previously oiled, which can be slowly turned like a screw, and for which, after a certain lapse of time, the index finger is substituted.

Gorgets are also employed, but these instruments are not, by any means, as useful or as certain as the finger. Some surgeons do not hesitate to replace simple dilatation by incision of the canal, which they perform on the sides by means of a probe-pointed bistoury. Billroth did this in a case which has been quoted above. I do not believe that it is necessary to resort to this measure except in extreme cases, when the foreign bodies are very large.

Observation by P. Bruns, of Tübingen.—Hair-pin in the bladder.—Dilatation.—Extraction.—A girl, aged twenty-four years, who had had a hair-pin in the bladder for several months, entered the Tübingen Clinic after three attempts at extraction with forceps had been made.

After being anæsthetized with chloroform, two superficial incisions were made on the superior and inferior surfaces of the neck of the bladder, and the seven numbers of Simon's dilator were introduced. A narrow forceps was then introduced into the bladder along the index finger, and the hair-pin was removed without difficulty, although it was markedly curved, as an effect, no doubt, of the previous operations. Each branch of this pin was seven centimetres in length. The operation was completed in a few minutes, and was not followed by any accident. It was proved by means of injections of water that the bladder was properly closed by the sphincter, and no incontinence of urine occurred afterward. (Schmidt's Jahrb., 1875, T. CLXVIII., p. 27.)

More recently Ledentu presented to the Surgical Society (1878) a vesical calculus formed around a hair-pin which had fallen into a girl's bladder five months previously. After anæsthesia, this surgeon dilated the uterus with the aid of a three-blade dilator, and then made two small lateral incisions. This preparatory manipulation enabled him to fix one end of the pin with the nail of one finger, to slide a forceps upon it and perform extraction.

The other preparatory operations are the same as for the male bladder, and consist of various injections, whose object is to facilitate the action of the instruments without wounding the walls of the bladder. The displacement of the foreign body with the finger only constitutes, properly speaking, a secondary manipulation in case the introduced finger can touch and move the body so as to make it present at the neck of the bladder in the most suitable position for removal. Many surgeons have thus obtained excellent results, and I cannot recommend it too highly, especially when combined with a vaginal examination, which enables the foreign body to be moved, displaced, and turned about through the septum, and thus facilitates its final extraction.

The patients must be anæsthetized prior to these manipulations, in order to avoid urethral spasm, exaggerated contractions of the bladder, escape of urine, and pain. A neglect of this precaution has been re-

[1] Boston Med. and Surg. Journ., 1876.

gretted on several occasions. Thus, as Monteil was withdrawing an incrusted etui eight centimetres long, his patient had a hysterical attack, very annoying convulsive movements, and prolapse of the mucous membrane of the vagina and rectum.

Extraction with the finger alone.—The finger alone has been used to extract a foreign body from the bladder. In reality we then restrict ourselves to facilitating spontaneous expulsion by a suitable dilatation of the canal and placing the foreign body in its axis. The following are two very curious illustrations:

FIG. 79.—Piece of wood removed from the bladder; natural size. (Union méd., 1873.)

Observation by Chapman.—Extraction of a foreign body from the bladder with the fingers.—"At the moment when the operator had left the patient in order to obtain a basin placed on a table, the instrument slipped into the bladder, which was considerably distended with urine.

The extraction of the instrument was effected by the unassisted finger, and without any previous resort to the introduction of prepared sponge. Although the operation presented some difficulties, it only caused slight pain, despite the unfavorable circumstances in the midst of which it was undertaken. It was in fact necessary to conceal the nature of the affection from the patient and family. I was not aware that the urethra was susceptible of ready dilatation. After having introduced a pair of forceps several times without any result, I decided to introduce my little finger for the purpose of determining the exact position of the instrument in a more positive manner. My little finger having entered without any effort, I introduced the index finger of the right hand until it came in contact with the large end of the instrument. I then slowly raised the latter and directed it toward the upper orifice of the canal, and, by the combined movements of my right index finger in the bladder, and of my left hand, which was applied to the abdomen, I succeeded in removing the instrument, although neither the patient nor any of the persons present suspected what had occurred. This catheter had been in the bladder for nearly three weeks." (Works of A. Cooper, p. 568.)

Observation.—Piece of wood in the bladder.—Expulsion after displacement.—"A young woman, aged twenty-one years, the mother of three children, had introduced a piece of wood into the bladder. The index finger readily passed through the urethra into the bladder. The patient had intense pain in the abdomen; the urine was sanguinolent. The foreign body was found to be placed transversely; one of the consulting surgeons, while exploring the bladder with his finger, succeeded in displacing the object. In consequence of this movement the patient was seized with an active desire to urinate. At her request, the patient was anæsthetized; a slight impulse sufficed to engage the foreign body in the canal, and it was expelled almost spontaneously. It was a stick cut to a dull point at one end, the other being surrounded by a broken wire." (Union méd., 1873, T. XV., p. 136.)

This plan deserves to be imitated, and may render useful services. Billroth moved a hair-pin in the bladder with his finger, and thus facilitated extraction.

Prehensile instruments.—As in the male urethra, simple hooks are useful, especially if the body is blunt and flexible; but they are very uncertain, and even dangerous, in pointed and rigid bodies like bodkins, pins, etc. The extraction of certain bodies has been sometimes effected by chance, by means of a simple metallic catheter in the eye of which they have engaged, and which they follow in its retrograde movement.

Observation.—Pin removed by a catheter.—"Lamotte, while searching for the fourth time for a needle in a woman's bladder, could not at first withdraw the catheter because the needle had accidentally become entangled in its two foramina. He succeeded, nevertheless, in removing them, but the needle tore the urethra slightly."

Ordinary forceps are often useful, but they have been objected to on account of acting by chance. Their action is much more certain when the dilatation of the canal enables us, as sometimes happens, to introduce

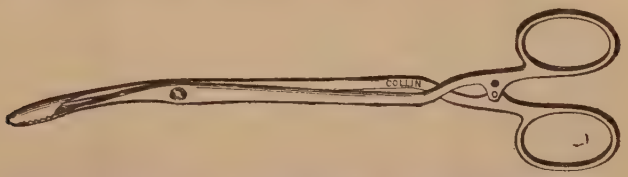

FIG. 80.—Forceps for the extraction of foreign bodies in the female bladder.

them upon the finger or to combine their action with vaginal touch, which, by raising the two lateral *bas-fonds* of the bladder, greatly facilitates prehension.

All kinds of urethral forceps, lithotrites, forceps, etc., have been employed. The objections to these instruments are that they do not seize the foreign body in a favorable position, and are somewhat uncertain in

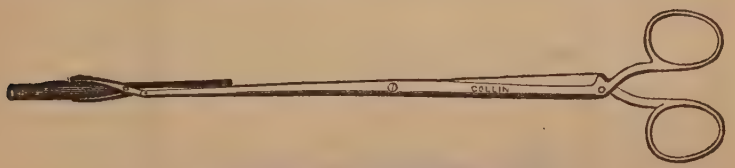

FIG. 81.—Urethral forceps in the foreign body.

their mode of action. At all events, if we employ them we must remember Caudemont's manipulation and endeavor to seize the foreign body at one end. Bouchacourt[1] had resort to Heurteloup's lithotrite in withdrawing a needle; this operation was brutal, as he was unable to determine what he was doing. It is better to employ the double forceps plan advised by the

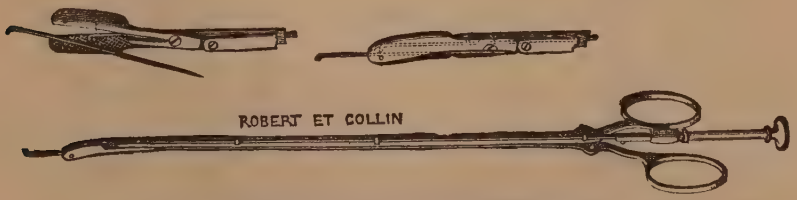

FIG. 82.—Reliquet's urethral forceps.

same surgeon.[2] All other instruments had failed to extract a pencil which was placed transversely in the bladder. Bouchacourt then introduced a lithotrite (child's size), and afterward a second one, seized the foreign body with one, which fixed it, while he searched for the point

[1] Gaz. méd., 1840, p. 700. [2] Ibid., 1845.

with the other. After he had grasped the point he removed the first lithotrite, and then the second with the foreign body, assuring himself, through the vagina, that he grasped the end firmly. This measure, based on the elasticity of the urethral canal, is capable of application in all cases of rigid foreign bodies which cannot be bent, crushed, or cut.

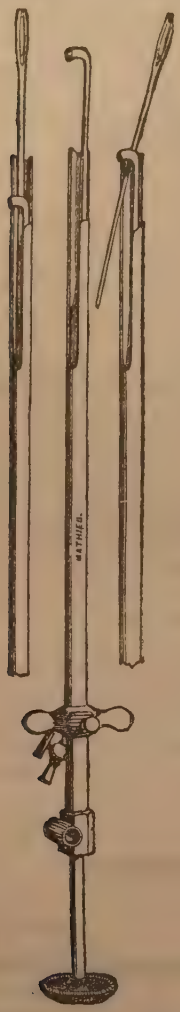

FIG. 83.—Mathieu's revolving redressor.

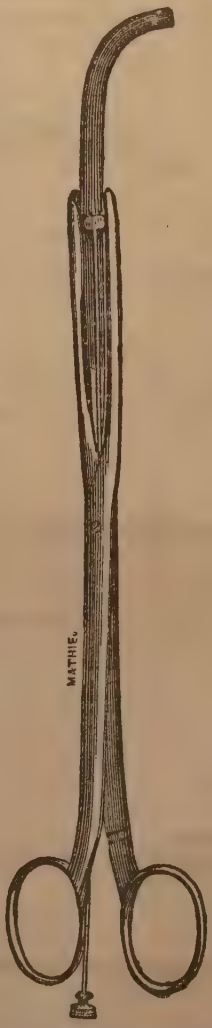

FIG. 84.—Leroy's revolving forceps.

Hunter's straight forceps, the spring-forceps described in discussing foreign bodies of the male bladder, are also capable of application, with a few modifications, in the female.

Redressors.—In order to avoid the inconveniences which result from defective prehension of rigid foreign bodies, some surgeons have conceived the idea of employing redressors, which enable them, when the body

has been seized transversely, to carry it into the axis of the canal. The best form is the redressor of Leroy d'Étiolles; but, in case of necessity, we may substitute Charrière's, Mathieu's, or Reliquet's. I republish from the latter author the description of Leroy's vesical forceps:

"Its general shape, says Reliquet, is that of the ordinary dressing forceps.[1] The long blades are concave and approach one another surface to surface, their concavities corresponding to one another. On one side and very near the ends, each blade presents a projection, and these are applied to one another, being imbricated when the forceps is closed. On the other side, upon one of the blades, is a projection which can be moved along this blade from its base to the extremity, by means of the wire which is applied against the blades and terminates in a button."

The instrument being introduced closed, is opened in order to seize the foreign body transversely. On pushing the projection, the latter carries the body along in front of it, makes it turn around the end of the forceps, and thus places it in the axis; it is then withdrawn.

Collin's basculeur.—The most recent instrument was devised a few months ago by Collin. It is composed of two parts, a sheath and a mov-

Fig. 85.—Collin's revolving redressor (the figures represent the various stages of the operation).

able forceps which revolves the foreign body upon the sheath after it has been grasped. Fig. 85 shows the various stages of the operation better than could be done by a long description. I cannot too highly recommend this instrument when the surgeon is summoned at the beginning of the symptoms.

Despite their ingenious character, redressors are not easily applied, and we should only resort to them in cases of firm bodies which are not too long and are not injurious to the bladder.

Duplicators.—The first duplicators were employed for the extraction of foreign bodies from the female bladder. It is useless to repeat that they are only used for flexible bodies, like pins, brass needles, straw, wire, etc. They are useful instruments.

In 1835, Branchetti invented a special forceps in order to extract a hair-pin from the bladder of a girl sixteen years old; it proved successful. A few years later, Spessa modified it in another case. These instruments were channelled forceps. In 1851, Betti, of Florence, substituted for the interior forceps a hook which drew the foreign body against the canula, when it had been seized transversely, and enabled it to be bent. He suc-

[1] Traité des opérations des voies urinaires, p. 673.

ceeded in removing a pin from the bladder of a young girl. A little later, Courty's instruments reproduced all these improvements, and has been most employed. We must also add cutting duplicators, etc., to the list. Leroy advised that the instrument be pushed upward and backward in proportion as the object was bent, in order to avoid wounding the walls, and especially the neck of the bladder.

Crushing and cutting instruments.—We rarely have occasion to reduce foreign bodies of the female bladder to fragments. This is explained by the fact that their simple extraction does not offer any great difficul-

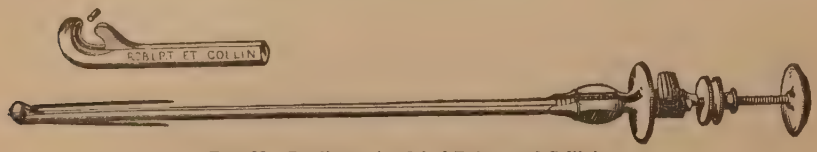

Fig. 86.—Duplicator (model of Robert and Collin).

ties, and when the inconveniences of simple extraction are too great, cystotomy may be performed. Fragmentation is only applicable to bodies which are not too hard, and the pieces of which are not dangerous to the bladder. Leroy d'Étiolles removed, in pieces, the handle of a mustard-pot, ten centimetres long, which was placed transversely. He cut it in two with a "stone-cutter."[1] There are also some other examples of this

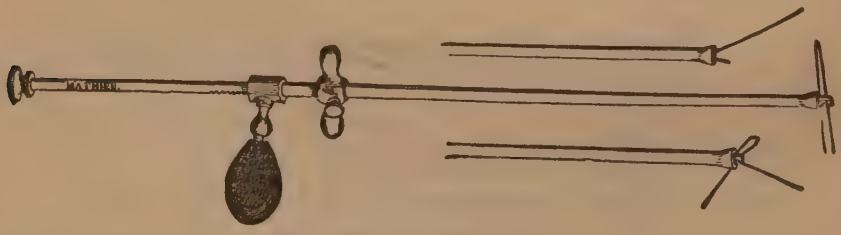

Fig. 87.—Duplicator (Mathieu's model).

kind in literature, and almost all have occurred under analogous circumstances.

When a concretion has formed around a foreign body, must it be crushed? This is a serious question, as the operation exposes the walls of the bladder to the danger of being wounded by the ends of the foreign body if it is rigid. We may perform it without fear if the calculus completely surrounds the foreign body, the size, character, and shape of which are previously known. But I think that there is great danger in applying lithotrity to needles and pencils, and that they overbalance, to a great extent, the advantages attending its employment. It is much better to perform cystotomy, which is simpler, easier, and does not expose the patient to the development of the grave accidents which may occur even in the most skilful hands.

Observation by Guyon.—Calculus formed around a hair-pin.—Lithotrity.—Vesico-vaginal section.—Death.—Autopsy.—On March 2, 1866, a seamstress, nineteen years old, entered the Necker Hospital in Lasègue's service, suffering from fever, leucorrhœa, and difficulty in micturition. She confessed that she had introduced a hair-pin into

[1] Académie des sciences, July 22, 1843.

the bladder two years previously. In the beginning she had pains in the abdomen and difficulty in urination; she had never passed any blood in the urine. Irregular menstruation; emaciation. The fundus of the bladder was painful to the touch, and the catheter showed the presence of a foreign body. Lithotrity was attempted on March 16th, but the calculus was grasped in a diameter measuring about 0.06 m., and escaped under the pressure of the instrument. After several attempts the lithotrite was withdrawn. During the day she passed several fragments as large as hemp-seeds. A second sitting was held on the 17th, but was not more successful than the first; the bladder then became more sensitive. On the following days the patient experienced very intense pains in the lower limbs and knees; the abdomen became tender and tympanitic, and the skin hot; high fever. Finally she presented all the symptoms of peritonitis. Interference became urgent in the presence of these grave symptoms. Guyon decided to perform vesico-vaginal section during narcosis. An incrustation of the walls of the bladder was noticed, especially in the upper part. He removed the pin, which was adherent to the apex of the bladder, and numerous small fragments.

After temporary improvement, the alarming symptoms continued, the patient presented a diphtheritic condition (angina, vulva, vagina), and she finally died on April 19th, nineteen days after the operation.

Autopsy.—Lesions were only present in the urinary apparatus. Left kidney: pelvis dilated, inflamed, congested. Cortical substance of kidney of a slaty color and strewn with abscesses of different sizes, the largest ones attaining the size of a hazelnut. Right kidney: no abscesses, cortical substance slate-colored. Pelvis inflamed.

False membranes in the vagina and on the edges of the incision. The bladder is retracted and the walls thickened. The cavity is lined by false membranes, which diminish its capacity, as their thickness is considerable; upon raising them the walls are found strewn with fungous growths; a small abscess is found on the left lateral wall. (Hybord: Th. de Paris, 1872, T. IV.)

In an analogous case, Passaquay of Lons-le-Saunier performed extraction through the urethral canal without resorting to lithotomy. A pen-holder had become the centre of a calculus. Thanks to the aural and anal specula which he used, the surgeon was fortunate enough to detect and seize the end of the pen-holder through the markedly dilated urethra. He drew the foreign body outward, but was compelled to abandon the efforts at extraction, which were horribly painful and produced terrible general symptoms. He took the precaution of bending the pen-holder, and a few days later he removed the calculus and the foreign body placed in its centre. Despite this success, we cannot recommend a practice which always produces such grave disorders, the least of which is long-continued incontinence of urine.

§ 2. Extraction through Artificial Passages.

Extraction through artificial passages includes that performed through spontaneous fistulæ, the perforations produced by the foreign body, and the operation of lithotomy itself, which creates a new passage.

The first measure is to some extent an operation of necessity, and we restrict ourselves to slightly incising the ulceration made by the foreign body or one of its parts. Two things in general are opposed to its escape after perforation: on the one hand, the shape of the body which opposes its elimination, as occurs with double hair-pins embedded in different parts of the wall; on the other hand, the existence of a calculous concretion formed upon the end of the body which is still in the bladder. Hence, there are somewhat different indications with regard to the manner of performing extraction.

In the first place, simple tractions cannot be too strongly deprecated, because we are ignorant of their effect upon the other portion of the body. In Dolignon's case, reported by Denucé, a piece of wood projected

partially into the vagina, and the attempts at extraction caused fracture of the foreign body. It was necessary to extract the piece which remained in the bladder by lithotomy. However, we must sometimes attempt to straighten pins. This was done by Panas,[1] in a young girl who had a double pin in the bladder. He succeeded in grasping it with a dressing-forceps, but, in exercising tractions in order to extract it, one point traversed the vesico-vaginal septum. Noticing this fact, the surgeon performed extraction through the vagina by pulling upon the foreign body and straightening the pin. These manipulations are always dangerous and irregular. It is better to solidly fix the perforating portion, than attempt to extract through the natural passages after having seized the foreign body at the bend. It is then pushed back into the bladder, is turned around, and extraction should be made by means of the curved portion. S. Cooper's and Boinet's method of version of urethral foreign bodies should be performed when possible.

We must avoid exercising too strong tractions upon calculous foreign bodies. If there is a vesico-vaginal fistula, we must not be afraid to make a lateral section in order to facilitate the escape through the vagina. Moreover, this is by far the most frequent site of this variety of perforation, and I know of only one case of extraction through a supra-pubic fistula.

Observation.—Lecieux relates that he extracted, through a vesico-vaginal fistula, twelve stones of various sizes, each of which had as a nucleus the bone of a fœtus which must have passed into the bladder five months previously, in consequence of a fall occurring in the fifth month of pregnancy. (Soc. méd. d'émulation, 1822.)

Lithotomy.—With other authors, I will divide the forms of lithotomy into two groups, according as it is supra-pubic or hypogastric, and sub-pubic. The second group includes urethral and vesico-vaginal lithotomy. I pass by in silence the so-called vestibular lithotomy of Lisfranc, which is condemned by nearly all surgeons. It is useless to insist upon the operative procedure of supra-pubic lithotomy, which does not differ in the two sexes. However, the conditions are here somewhat less favorable, because there is always a superabundance of fat at the situation of the incision, and also because the bladder does not retain injections so well as in man.

Supra-pubic lithotomy for the extraction of foreign bodies has been performed only a small number of times, and the results are far from satisfactory. This is shown by the following illustrations:

Observation.—Extraction of an iron pin by the high method.—Death.—A girl, aged 19 years, introduced into the urethra a long iron pin, which fell into the bladder. Through shame she concealed her mishap for eight months. The pains which she suffered produced such a visible emaciation that her relatives noticed it, and succeeded in making her confess the cause of her trouble. A surgeon introduced a steel sound, and detected the foreign body with difficulty. The introduction of the finger into the vagina did not reveal any induration or tumor. In order to detect the foreign body, which was so obstinately hidden, he dilated the urethra with prepared sponge, and having introduced the finger into the bladder, with the assistance of a gorget he distinctly felt the pin, more than a third of which was incrusted with calculous matter. The calculous portion was lodged near the anterior and superior portion of the bladder, in a kind of pouch which this viscus had formed around the concretion. The remainder of the pin traversed the bladder from right to left. The surgeon did not dare to perform extraction of the foreign body with forceps introduced into the ure-

[1] France méd., 1876, p. 126.

thra. Lithotomy by the high method was decided upon, and the stone, the nucleus of which was formed by the pin, was readily removed. Despite all the measures employed, the girl died on the third day after the operation. (Académie des sciences de Paris, 1758.)

Observation.—Supra-pubic lithotomy, performed on a woman twenty-eight years old, in order to remove from the bladder an etui which had remained there for three months. It was incrusted in its centre, and this explains the necessity of the operation, despite the previous dilatation of the urethra. Death on the twenty-first day. (Rétif : Diss. sur les corps étrang. de la vessie, Paris, 1811.)

Urethral Section.—The methods of performing urethral section vary according as the incision is made high up in front, on one side and transversely, or on both sides in the same direction. The terms, Collot's section given to the first, lateral section to the second, and bilateral section to the third, take these differences into consideration. The incisions are made with a probe-pointed bistoury (Billroth), or, better still, with Frère Côme's lithotome for urethral section. The two latter methods appear to have been employed in preference to the first. In 1868, Richet[1] performed simple lateral section in order to remove a calculus formed around a hair-pin.

Petrequin performed Collot's urethral section in order to remove a bodkin eight centimetres long from the bladder of a young girl. He incised the urethra on one side high up, and a little to the left, with the concealed lithotome. The author applies the term urethro-vestibular to this plan, but it does not differ from Collot's and Dubois' urethral section. Finally, bilateral section was performed in another case.

Observation.—Bilateral section for extraction of an etui.—Recovery.—"A girl, aged 20 years, had introduced into her bladder a wooden etui filled with pins and sewing-needles. Having placed the patient in the proper position, Rigl injected the water into the bladder, and cut the urethra on both sides with the concealed lithotome. The position of the etui, which was situated behind the pubis, was changed by means of the finger, after which it was grasped and withdrawn. It was three and a half inches long, and an inch and a half in circumference. The patient made a perfect recovery." (Annales de la Soc. de méd. prat. de Montepellier, 1810.)

Whatever may be the form of urethral section performed, the patient is placed in the position for a speculum examination, after the bladder has been injected and the rectum emptied. The incision is made during the first stage, and extraction with the aid of suitable forceps in the second. Is it necessary to introduce a catheter *à demeure* after the operation? Modern authors do not favor this plan, and regard it as either useless or dangerous. Only a few years ago surgeons never omitted this precaution, for fear of urinary infiltration; but experience has taught our contemporaries better. Its slight utility in Fleury's case, in which it served the girl as an instrument of masturbation, also deserves to be taken into consideration.

Vesico-vaginal section.—This consists in the formation of an artificial passage for the foreign body through the vesico-vaginal septum. Some introduce sutures after the operation, others do not; but the operations remain practically the same. The patient is placed on the back, according to the French plan, on the abdomen, as Velpeau advises, and on the side, according to the American plan. A catheter or a curved grooved director being introduced into the urethral canal, projects at the fundus

[1] Thèse d'Hybord, 1872.

of the bladder into the vagina, which is dilated by means of an English speculum. With his left index finger the surgeon steadies the groove of the catheter, and cuts upon the latter in such a manner as to reach its groove. Without leaving this he then cuts from behind forward to the neck of the bladder; this gives the incision a length of two or three centimetres.

Vallet makes a transverse incision, and uses for this purpose an articulated catheter, which can be bent in the bladder at a right angle. Sutures may be introduced after extraction, which is performed in the usual manner; but we must not rely too much on its results, and should rather endeavor to secure secondary union by granulation.

Bouisson performed vesico-vaginal section in order to withdraw, from a girl's bladder, an elongated calculus whose nucleus consisted of a metallic pen-holder which had been introduced through the urethra. For this purpose he made an incision along the median line of the septum. Guyon has also performed this operation. Under certain rare circumstances, the incision is made upon the projecting foreign body. Thus, Denucé reports that he withdrew through the vagina an embroidering-needle, which projected and could be readily seized with forceps, but which was retained like a hook. The incision on the projecting body was very easily performed, and it was then removed.

Treatment after Extraction by Various Methods.—Whatever may be the method employed, the bladder should be cleaned, after extraction, by means of detergent injections of large quantities of water. The patient should then be kept quiet, and the diet should be restricted for the first few days. Should a catheter be introduced into the bladder *à demeure*, should catheterism be performed several times a day, or should the emission of urine be left to itself? Several cases must be taken into consideration, according as the extraction has been performed by this or that method. In a general way there is no advantage in performing catheterism during the first few days, as it does not prevent the incontinence which is the almost inevitable result of the dilatation. If the ammoniacal urine irritates the parts and inflames the inner surface of the thighs, it is better to introduce a securely fastened catheter *à demeure* and an urinal.

Bloody extraction is always followed by an urinary fistula, which requires further care and a special operation in order to relieve the patient from a disgusting infirmity. Before attempting anything we must wait until the cystitis disappears, the urine becomes clear and normal, and the general condition, which is compromised by the presence of the foreign body, has improved.

Comparative Results furnished by Various Methods.—As I have stated above, extraction through the natural passages, even at the very beginning, has scored some brilliant successes. It is evidently a simple, natural, and rational method, and presents the great advantage over lithotomy of not frightening the patients by the fear of bloody interference. Is it necessary to enter into a long dissertation in order to prove the excellence of a method which daily secures the approval of surgeons more and more? It presents great advantages when the foreign bodies to be extracted are situated in the bladder, and especially in this particular case, because the urethral canal is already dilated in individuals who are the victims of this class of accidents, and little is necessary in order to obtain the degree of dilatation necessary for exploration and for manipulations with the fingers and instruments.

But does this imply that the extraction is free from failures, and that

complications are never produced? There is no doubt that no method can make such pretensions, and, like the other plans, extraction through the natural passages presents some inconveniences. Patients have sometimes died in consequence of the operation, and the opponents of this method have carefully collected all the cases which can throw discredit on urethral dilatation, which they chiefly oppose. But, as the reader can convince himself, we cannot accuse the dilatation as the cause of these accidents, which are due to the manipulations in the bladder, or are the so frequent final complications after various forms of lithotomy as well as after dilatation and extraction. One woman, whose history has been reported by Labbé, died of purulent infection.

Observation.—Etui in the bladder.—Extraction.—Death.—Eighteen months ago a woman entered La Pitié who had introduced a needle into the urethral canal. Dilatation of the canal after chloroform anæsthesia. Extraction of an etui 0.08 m. long, incrusted with calcareous salts. Symptoms of purulent resorption. Death. (Société de chirurgie, February 9, 1876.)

The causes of death were even more general in Nélaton's patient, who died of erysipelas.

Observation.—Foreign body in the bladder of a pregnant woman.—Extraction.—Confinement.—Erysipelas.—Death.—A woman, aged twenty-seven years, entered Nélaton's service, suffering from a vesical calculus; she was in the fifth or sixth month of pregnancy. A hard body of a considerable size was found in the bladder. The patient confessed that a small twig, seven centimetres in length, had fallen into her bladder; from that time she suffered from severe pains in the bladder, which increased at every moment. Nelaton proposed the introduction of a cone of prepared sponge in order to dilate the urethra, but the finger entered with facility. The patient being anæsthetized, Nélaton slipped along the finger, which had been introduced into the bladder, a dressing-forceps which seized the foreign body in the middle. One end was then grasped by a second pair of forceps, and a piece of wood was removed, six centimetres in length, and covered by calcareous concretions. Although the operation had been simple, erysipelas developed in the genitals, the left labium majus became gangrenous, and the erysipelas attacked the right thigh. Four days after the operation she was delivered of a fœtus which only lived a few minutes. Nélaton made fruitless attempts to remove the placenta, which was delivered by the interne an hour and a half afterward. The erysipelas continued, purulent deposits formed in the knee and forearm, and the patient died on the seventh day.

At the autopsy, among other lesions, two depressions were found in the bladder corresponding to the lesions produced by the ends of the foreign bodies. The urethra showed traces of erosions. (Hallé: Gaz. des hôpitaux, p. 221, 1862.)

The dilatation has been accused of producing incontinence of urine, which, if not permanent, is at least very persistent. In fact, on reading the articles published in the journals, it is found that incontinence is frequent, but rarely rebellious, and that this infirmity disappears at the end of several weeks, sometimes several months, when properly treated. Moreover, this accident is rare if the dilatation is performed methodically, and if care is taken to dilate the canal slowly and intermittently, after the production of anæsthesia. It is not necessary to injure the parts, and we can thus succeed in obtaining a diameter of two centimetres, which will be sufficient when the foreign body or concretion is not too large.

Does lithotomy present any results comparable to those of natural extraction? If we exclude the statistics of supra-pubic lithotomy, which is an unfavorable operation in woman, since, according to Denucé's tables, there have been five deaths among seven cases, we find that the various other infra-pubic operations are very advantageous with regard to operative mortality. The same author has succeeded in collecting only two fa-

tal cases among fifteen operations made for the extraction of foreign bodies. Several unfortunate cases have been published since. Thus, Guyon saw one of his patients, who had been operated on for vesico-vaginal section, die during the course of a renal affection. Recently, Zoeinbieki reported a case of death after vestibular section, but we can attribute this result to the employment of a faulty method of operation. The following is the history of the case :

Observation.—Zoeinbieki presented a calculus the centre of which was occupied by a pin-case around which calcareous and phosphatic layers had been deposited under the form of a complete envelope. The length of time during which it had been present in the bladder had not been determined, the patient refusing to give any information. For two or three months she had presented all the ordinary symptoms of vesical calculi, such as cystitis, incontinence of urine, hemorrhages, radiating pains, and the escape of fine gravel. The patient had been sent to the hospital because she was supposed to be suffering from stone.

It was only after protracted, fruitless manipulations at lithotrity that a large foreign body was recognized, after the urinary reservoir had been explored with the finger. It became necessary to make the operation of vestibular lithotomy, and it was only after it had been performed that the calculus could be removed. The patient died of purulent infection. (Bull. de la Soc. anat., 1874.)

Lithotomy is none the less a good operation despite a few failures. For numerous reasons, the majority of authors prefer vaginal incision to urethral lithotomy. In this way incontinence is more surely avoided. The incision of the septum undoubtedly leads to the formation of a fistula, but the cure of this affection is very simple at the present time. However, Pamard d'Avignon failed in several attempts in the case of a young girl, because the wilfulness and the vicious habits of the patient forced him to resort to cauterization in order to treat the fistula, which was rebellious to sutures.

The choice of a method of treatment.—When the surgeon is called at the outset, and obtains sufficient information concerning the nature of the foreign body, he may choose among various methods of treatment. They are determined according to the individual case. Is it not evident, for example, that extraction with forceps should be the rule, when a portion of the body has already engaged in the urethra. In a general way we must begin by resorting to the simplest methods, to those which give the best results without exposing the patients to any risks.

If the urethra is accessible to the fingers, if it is supple and dilatable, we must attempt to direct the foreign body into the axis of the urethra, after having recognized its presence and situation, and cause it to be expelled by means of injections. But these measures often fail, and it is better not to wait for a very problematical natural expulsion, and to resort at once to dilatation by the finger or by instruments constructed for this purpose. When the urethra is elastic and supple, and will sustain sufficient dilatation, these preparatory manipulations will suffice to afford an entrance into the bladder and to withdraw the body. If these conditions are not found combined, it is better to imitate the conduct of Billroth and Ledentu, and to make free lateral incisions, which are not dangerous and spare the urethra.

The choice of the surgeon, with regard to the measures which should be employed for extracting the foreign body, must be based upon the nature of the object, its susceptibility to being bent, cut, straightened, etc. Whenever possible, it is best to attempt to remove it by one end, the ob-

ject being turned and placed in the axis of the instruments. I can give no positive precepts in this respect, because they vary so infinitely.

What is to be done when the body remains in the bladder for a certain length of time, and becomes the nucleus of a calculous concretion? In such a case we must be certain that extraction through the natural passages is impossible, before resorting to lithotomy. When the bladder is in a very bad condition, and the general health is compromised by an advanced cachectic condition, it is better to resort at once to lithotomy than to attempt extraction. In fact, this operation very frequently cannot be performed until the calculus has been crushed, or until the performance of manipulations of prehension or displacement, which are not inoffensive in a healthy bladder, and which may be very injurious in the diseased organ. On the contrary, we must attempt manipulations at extraction when the bladder is only slightly affected, the urethra supple and dilatable, the calculus small and elongated.

Lithotomy should therefore be reserved as a last resource in the worst cases, in those in which the other methods are inefficient or dangerous. Apart from the condition of the bladder, some other circumstances almost demand its employment. These include the large size of the calculus, the fragile nature of the foreign body, the perforation of the fundus of the bladder by one of its irregularities, etc.

Finally, if the performance of lithotomy has been decided upon, the surgeon should employ urethral or vaginal section in preference, according to the special cases and indications.

PART V.—FOREIGN BODIES OF THE EAR.

CHAPTER I.

DEFINITION.—DIVISION.

Authors are in the habit of combining, in one chapter, the history of foreign bodies which have come from without and ceruminous concretions which have formed in the external auditory canal. In the present investigation I will occupy myself only with animate and inanimate bodies which have come from the exterior, as they alone correspond to the general definition, although the masses of concrete cerumen play the part of foreign bodies. This category is extremely large, and I will not include parasitic or helminthic affections, which constitute a distinct chapter in the history of diseases of the ear. The larvæ of worms have undoubtedly been the cause of frequent grave symptoms, and have been directly deposited by insects, but they present considerable analogy with worms, nematodæ, and entozoa, and differ from other solid bodies with regard to their nature and mode of existence. Whether the larvæ are introduced in alimentation, or are deposited by the animal, the circumstances of penetration remain the same, and we must regard this group of accidents as a curious variety of parasitic disease. If the animal which deposits the eggs remains imprisoned in the canal, it would be proper to combine their study with that of foreign bodies; but it is a curious circumstance that the insect is never found in the ear, and its introduction has not even attracted the attention of the patients.

The fluids which are accidentally found in the ear do not constitute foreign bodies properly speaking, and the slight disorders which they produce, when they do not possess noxious properties, whether chemical or otherwise, authorize me in passing them by in silence. When thus limited, the list of foreign bodies of the ear comprises all solid or semi-solid substances, whether animate or inanimate, which have come from without, and which are abnormally present in the external auditory canal.

CHAPTER II.

ETIOLOGY.

There is nothing more variable than the cause of penetration of foreign bodies into the ear. It results, in the majority of cases, from an accident or involuntary manipulations. The examples of introduction are especially frequent in childhood, and, according to Desprès, children from

four to eleven years of age, are more especially predisposed. In fact, it is at this age that, while playing, and without suspecting the importance of what they are doing, and without any knowledge of the consequence of their actions, they introduce into the natural cavities, especially those of the head, all objects which come into their way, from peas, coffee-beans, beads, to pellets of bread, paper, or dolls' heads. The class of bodies found in the ears of infants is extremely varied.

Apart from this unfortunate instinct, which daily produces victims, childhood is predisposed more than other periods to the arrest of foreign bodies, because suppuration of the ear is very frequent, and the discharges, which are always very fœtid, attract certain animals (musca carnaria, muscida sacophaga), which find here a proper medium for hatching their larvæ. This circumstance is, however, not peculiar to that age, and also counts its victims in adult life. But insects may also penetrate into the ear in several other ways. Thus, it has been very frequently noticed that flies, earwigs, etc., enter the auditory canal during sleep, in reapers who sleep in the fields. It is chiefly in this way that we explain the origin of the insects, a small number of examples of which are presented in literature.

The distinguished Ravaton relates that he himself was the victim of an accident of this kind. One day, while sleeping in a field, he was awakened by a very sharp pain in the right ear, which kept on increasing, and became so intense as to cause delirium and endanger his life. He was cured by the removal of an earwig from the canal.[1] In another example, a cricket entered the ear during sleep, in the case of a peasant, which was reported by Fabrice of Hilden.

If we ask under what impulse these insects enter the ear, we must reflect that the auditory canal constitutes a cavity like those frequented by the animals. We are far removed from the period in which Ravaton thought that the earwig entered this organ "for the purpose, no doubt, of drawing nourishment from the wax which it finds there, and which it is very fond of."

The insects sometimes enter the canal without any appreciable cause, and the cases in which man has interfered, in order to favor their introduction, are very rare. I will only mention, as a curiosity, the case of the man who, while reading, being tormented by a fly which was buzzing around his head, and endeavoring to get rid of it, succeeded in pushing it into his ear, where it became the origin of grave symptoms. In another instance, a child held a lady-bug in the half-closed hand, and held his fist against his ear in order to hear the buzzing of the insect; the latter entered the auditory canal while endeavoring to escape.

Certain habits have more than once been the cause of the arrest of foreign bodies in the ear. Without speaking of the mania which certain persons have of forcing into their ears all the objects which they hold, I confine myself to the habit of closing the auditory meatus with tampons of cotton. How often have these pellets of wadding, which have been forgotten, and forced in too deeply, become the source of functional disorders and accidents! These bodies may be present without the knowledge of the patients, and they very frequently attribute to some other cause an affection which is only the result of their own negligence.

The other cases of penetration only occur under very rare and exceptional circumstances. This is true of the strange case reported in an

[1] Ravaton, t. II., p. 383.

American journal,[1] of a woman who poured molten lead into her husband's ear during his sleep. We must also regard the fact that fluid plaster flowed into a man's ear, as a singular fatality; in this case, which is referred to by an English author, the plaster soon set and gave rise to accidents.[2]

In some cases aural therapeutics has given rise to the origin of foreign bodies of the ear. In fact, the small metallic or caoutchouc eyelets, which are used in aural surgery to give free vent to pus in the cavity of the tympanum, have several times fallen into the latter, and exposed the patients to great dangers.

The accidents which form the subject of the following observation are also due to the same cause; it refers to an artificial tympanum which was lost in the ear.

Observation.—Artificial tympanum lost in the ear.—Toynbee's artificial tympanum was introduced in a girl fourteen years old, who had lost the tympanum, and who was also affected with profuse otorrhœa. Upon withdrawing it the handle broke and the plate remained in the ear. In an examination made on the fourth day by Zaufal, only the whitish gray surface of the plate could be seen; from a brown its color had become gray. After fruitless attempts at extraction by injections and forceps, it was easily effected with the aid of a small hook with which the surface of the membrane could be seized. (Schmidt's Jahrb., 1877, T. CLXXIV., p. 210.)

Zaufal refers to artificial otoliths produced in the course of otorrhœa by insufflations of alum, which become thickened by being mixed with pus, and become true foreign bodies by their agglomeration.

Finally, in order to be complete, I must add to all these causes the voluntary introduction of foreign bodies into the ear, by those who hope to draw benefit from the consequent functional infirmity by being exempted from military service. The unfortunate fate of a young soldier, whose history is published by Champouillon, is not attractive to those malingerers who wish to resort to this subterfuge.[3] This man had introduced a small stone into the ear, and it was discovered near the tympanum, which it had perforated. H. Larrey performed extraction, but the inflammatory symptoms did not improve, and the inflammation spread to the meninges, resulting in meningitis and death.

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[1] American Journ. of Med. Sciences, 1875.
[2] Dalby: Lancet, 1875, T. II. p. 447.
[3] Gaz. des hôpitaux, 1854, p. 353.

CHAPTER III.

THE NATURE OF FOREIGN BODIES OF THE EAR.

THE following table, which is based on the most essential physical properties, will convey an idea of the foreign bodies of the ear.

- **Foreign bodies.**
  - **Animate.**
    - Insects.
    - Earwig.
    - Fly.
    - Fleas.
    - Bugs.
    - Cricket.
    - Lady-bug.
    - Centipede.
  - **Inanimate.**
    - **Regular.**
      - **Hard and unchangeable.**
        - Teeth.
        - Cylinders of graphite.
        - Tin or copper ball.
        - Lead, balls of lead.
        - Brass buttons.
        - Marbles.
        - Coral beads, etc.
      - **Friable.**
        - Glass.
        - Beads of glass.
        - Shells.
        - Porcelain button.
        - Doll's head.
      - **Organic and changeable.**
        - Beans.
        - Dried peas.
        - Coffee-beans.
        - Pellets of paper or bread.
        - Cherry or plum pits.
        - Sugar.
        - Fruit-pits.
        - Elder-pith.
    - **Irregular.**
      - **Soft—can be cut.**
        - Grains of oats.
        - Grains of corn.
        - Head of barley.
        - Grain of corn.
      - **Firm.**
        - Pins, needles.
        - Ferule of an iron pen-holder.
        - Molten lead.
        - Corset eyelets, etc., etc.

This classification, based on physical properties, corresponds to the notions entertained by Tillaux and Duplay.

The importance of the division into animate and inanimate bodies will be obvious to every one, but it interests the practitioner much less than the subdivisions which are based on the physical properties of the substance. These distinctions have a real value, especially from a therapeutic point of view, since interference differs according as the body is regular or not. Even among those which assume a more or less distinct geometrical shape, it is necessary to establish categories based on their consistence, changeability, firmness, etc., because they will give rise at a later period to special indications, which it is important for the surgeon to recognize.

I will review some of these physical properties of foreign bodies for the purpose of allowing a better comprehension of their mode of action,

their final evolution, the accidents which they produce, and, up to a certain point, for the purpose of permitting a view of the rational therapeutics, which is proper to each class.

Animate foreign bodies are very rarely observed, and we can very easily count the number of operations which are scattered in literature. There is reason to think that many of these cases remain unknown on account of their simplicity and the efficacy of the most simple treatment. Despite this relative infrequency, I do not think that we can affirm with Sockeel[1] that no case of this kind can be found in literature. The insects are usually small, like flies and fleas, but, in some cases, their size is worthy of notice. Thus, a centipede, which was removed by a mother from the ear of her child, measured more than two centimetres in length; and the cricket is also a large foreign body, when compared with the dimensions of the auditory canal.

These insects act in several ways, not only as irritating bodies, but also by the movements of their claws and wings, which produce a very intense irritation of the membrana tympani and of the auditory canal. They sometimes die quickly; sometimes, on the contrary, they continue to live in this medium, and their struggles increase the symptoms.

Irregular inanimate bodies are divided into three classes, according as they are hard and unchangeable, friable, or, finally, organic and changeable. It is evident that the first are found in more favorable conditions for tolerance than the others, because their size does not change. Furthermore, they rarely fill the lumen of the canal completely, as the latter is not regular, and its transverse section presents the shape of an ellipse. This fact is not an unimportant one, as the physician may pass an extractor between the upper or lower wall and the foreign body. Small leaden balls, teeth, coral beads, etc., belong to this category.

It is necessary to place friable bodies in a special class, because an appropriate treatment must be applied to them, which is applicable to them alone, and which enables them to be extracted without being broken, or assures the protection of the walls. Glass and porcelain objects, shells, etc., belong to this class.

The group of organic and changeable bodies is very interesting, on account of the changes which occur in their size and consistence. These especially include grains which are capable of absorbing moisture from the auditory canal, and which, by this imbibition, increase in size to such an extent as to entirely fill the lumen of the canal, and to produce certain symptoms. Beans, peas, and coffee-beans are the most perfect types of this class. This phenomenon is not only interesting with regard to the aggravation of the symptoms produced, but it also gives rise to new therapeutic indications. No space except the inferior and superior openings remains for the passage of extractors, or for the entrance of injections of water.

Imbibition also acts in a different way upon the hardest or softest bodies, like fruit-pits, pellets of paper, or pieces of bread. All of them become swollen under the influence of this process; but, while the pits increase in size and retain their hardness, the other bodies become softened when they imbibe fluid. Moreover, we must not forget that this phenomenon is very slow, as the auditory canal does not contain any moisture primarily, and the swelling only becomes very appreciable when inflammation and exudation supervene. All things being equal, its course is much slower in the case of fruit-pits, etc., than in that of dry grains.

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[1] Thèse de Paris, 1868.

This imbibition never leads to disintegration as in foreign bodies of the air-passages, and it is readily understood that, under the conditions actually present, the body is less favorably situated to undergo this change.

Finally, irregular bodies, whether organic or inorganic, act chiefly by their irregularities, which, by wounding the walls of the canal, may become firmly embedded. Pins, needles, particles of ivory, etc., belong to this category. I have thought it useful to establish a distinction among them, based upon their rigidity and the possibility of breaking them, because this plan is one of the most natural which presents itself to the mind of the surgeon. In discussing treatment, the utility of this division will be even better justified, and I will now confine myself to the statement that some of these bodies are very long compared with the dimensions of the canal (pins, needles, heads of grain), and that others assume very irregular shapes, as, for example, molten lead and hardened plaster.

Finally, we must add that some of these bodies are capable of being burned, and we shall see that this property has been utilized by some surgeons in order to relieve the economy of certain foreign bodies of the ear. (Voltolini.)

Situation, Mobility, Fixation.—The majority of the bodies are situated in the external auditory canal. Some act like bodies which have entered by effraction, and penetrate at once into the middle ear. We can very readily understand that molten lead can thus immediately traverse the membrana tympani. But these are exceptions, to which I refer on the way, and I will add that the other bodies only penetrate the tympanum secondarily, either as the effect of a process of ulceration from compression, or from mechanical rupture, or finally, in consequence of inflammation.

When the patients present themselves to the physician, the situation occupied by the foreign body is always very deep. This fact is accounted for by several reasons. In the first place the patients, at the outset, instinctively carry the hand to the ear, and the inevitable effect of this manipulation is to still farther introduce a body which was only at the meatus. When the finger is unsuccessful in enabling them to make attempts at extraction, it is not rare to find them resorting to ear-picks, matches, or hair-pins. The latter instrument is especially employed by mothers when this variety of accident occurs to their children. Whatever may be the measure employed, the result is very frequently the same, and these inconsiderate manipulations end in forcing the body inward, if it is movable and regular. When the patients, outsiders, or even physicians persist in attempts at extraction (without sufficient precautions) of foreign bodies which demand special indications, the latter have succeeded in bursting through the membrana tympani, in penetrating into its thickness or even falling into the cavity of the middle ear. These cases are very frequent, and all authors who have written on the subject report illustrations of it, to which I shall refer in discussing diagnosis.

Among the bodies which are situated in the canal, some are fixed, others are movable, or, at least, endowed with a certain amount of mobility. All large foreign bodies, which are at the same time somewhat irregular, are immovable. But fixation is especially observed with regard to hard, pointed objects, like pins, spikes, needles, grains of oatmeal, the points of which are buried in opposite parts of the canal. The cutting edges of shells, teeth, etc., also favor the enclosure of a certain number. Finally, grains or pits, which can be swollen by moisture, possess no mobility, on account of the pressure which they exercise upon the wall.

However, prior to this imbibition, certain bodies may be displaced in one direction or the other, and we can conceive that the mobility and fixation vary according to the size, shape, consistence, and manipulations which have been performed.

What degree of mobility or fixation do insects possess? As a rule they are very movable, even apart from the movements which they may execute with their claws or wings during life. Some of them, being agglutinated by the cerumen, cannot be extracted whole; but there is every reason to believe that the animal is not firmly adherent to the wall.

CHAPTER IV.

PRIMARY PHENOMENA AND SYMPTOMS.

In this chapter I will review the sensory disturbances and the functional disorders which appear immediately or shortly after the introduction of foreign bodies into the ear. Before entering upon this study, I must remark that the accident is very frequently not accompanied by any apparent disturbance, because patients do not always detect a slight diminution in acuteness of hearing, which is confined to one side. But in many cases this is the only phenomenon produced, and whatever the body may be, whether it is large or small, superficial or deep, regular or irregular, its interposition in the course of the waves of sound will produce a disturbance of the auditory function. When the effect is confined to this, we are accustomed to say that there is tolerance, as patients often do not notice anything; but, in reality, it is only a relative tolerance or prolonged indolence. I will give an account of this tolerance in a special paragraph.

Animate and inanimate foreign bodies produce an effort by their mere presence and by mechanical action; by their presence they produce functional disorders and irritate the walls of the auditory canal; by their mechanical action they compress the walls or the membrana tympani, and in this manner give rise to the most severe accidents.

1. Functional Disorders.—A little while ago I stated that the presence of a body which is interposed between the external medium and the tympanum produces modifications in the perception of sounds. This very common fact does not need an explanation. All bodies do not by any means produce these functional disorders to the same extent, and we can readily understand that the larger and more compact the objects are, the more marked will the deafness be. On the contrary, a grain of oatmeal, a needle, etc., which is imbedded in the walls of the canal at their ends, allow the largest portion of the sonorous waves to enter and only produce a very slight interference with audition. Between peas, which become swollen and obstruct the lumen of the canal, and slender objects placed on edge, we can place an entire series of intermediate bodies which correspond to the infinite varieties of practice. Very frequently, especially in the beginning, a small passage remains above and below the obstacle and places these two portions of the canal in communication. In some cases, finally, the foreign bodies are pierced in the centre, and only cause very slight functional disorders.

Apart from this diminution in the acuteness of hearing, a perversion of sensations and the production of abnormal sensations have been observed on several occasions. The most common accidents of this kind are roaring noises, which greatly fatigue the patients by their intensity. They are not only present when the sound-waves arrive in the auditory canal, but they are also produced spontaneously, and then assume the strangest forms. Simple tinnitus is much more frequent, especially in the first period, because the foreign body is not yet tolerated by the canal, and the patient has not acquired the habit of supplementing the diminution in acuteness of hearing. Despite the relative tolerance of the ear, these sensations may persist, as in the following example:

Observation.—Piece of a pencil remaining in the ear for seven years.—Intermittent deafness.—A young girl had a piece of slate pencil in the right ear for several years; a vain attempt to remove it had been made at the period of the introduction. Since then she had been subject to a periodical return of deafness, during which she constantly heard a roaring noise, which she compared to the noise of leaves rustling in the wind. Mertins, having been consulted, repeated the attempts at extraction, and succeeded in grasping the fragment with Bossemer's ocular forceps; he then removed the object from the ear. It was 12–15 millimetres long and was incrusted with hardened cerumen. The deafness and tinnitus ceased from this time. (Mertins de Wongraviée: Med. Zeit., 1842, p. 32.)

These noises have been several times compared to the rustling of leaves or to the roaring heard by the healthy ear when applied to the opening of a large shell. Finally, it is not rare to find that the patients compare this roaring to that produced by a swarm of bees. Deleau reports a curious example:

Observation.—Grain of oatmeal in the ear.—Various functional disorders.—In May, 1821, François Parisot, while passing near a horse who was neighing, suddenly felt a sharp pain, which continued despite the extraction of several grains of oats which had entered his ear. For three days he was unable to eat or to blow his nose. When he sneezed, the painful feeling increased with such violence that he became temporarily confused. During the day his nervous condition prevented him from going to work, and it was impossible for him to obtain an hour's sleep at night. He compared the noises in his head to that made by a swarm of bees which was escaping from the hive. All these accidents ceased after the extraction of a grain of oat (commonly called wild oat), which had remained at the bottom of the canal, and the sharp end of which, covered with bristles, rubbed against the surface of the tympanum a little below the insertion of the handle of the hammer. (Deleau, Jr.: Gaz. méd. de Paris, 1834, p. 162.)

The same author has also observed identical phenomena produced by a flea, which, by hopping upon the tympanum, caused a roaring analogous to that made by a swarm of bees.

2. Subjective Disorders.—The contact of a foreign substance with the mucous membrane of the canal almost always produces a very disagreeable irritation—a distressing, undefinable sensation, which varies a great deal according to the individual. If the contact persists, pain appears, which is almost always very acute, sometimes limited to the canal, but very often radiating into the other parts of the ear and into the head. The larger, sharper, and more irregular the body which has been introduced, the more intense the pain will be. This is also true with regard to its depth, and the fruitless attempts which are made to relieve the patient very frequently produce the opposite effect. If the foreign substance comes in direct contact with the membrana tympani, the pain increases still more and becomes excruciating and intolerable, especially if the living or movable body changes its position on the surface of this

organ. The authors who have written on this subject always lay especial stress on the excessive intensity of the sufferings experienced by individuals who have an insect in the ear. (Colin,[1] Bourgeois.[2])

But there are very great variations in different cases, so that some persons have no recollection of the period of introduction. It is evident that a tampon of wadding or a ball of paper will not irritate the walls of the canal to an appreciable extent. It is very rare to find the pain persisting for a very long time, as it disappears almost entirely at the end of a few hours or days, if no serious accidents occur, and reappears during the performance of certain physiological acts, such as sneezing, coughing, blowing the nose, or even mastication.

3. Reflex Disorders.—By the side of these subjective disorders we must place the entire series of very curious reflexes which sometimes appear after the introduction of foreign bodies. They are sometimes slight, being confined to the irritation of an adjacent nerve (chorda tympani). They are sometimes very severe and react over a greater distance, for example, upon the anastomotic filaments of the pneumogastric nerve. Finally, the irritation of the nerves of the mucous membrane of the canal may become the starting-point for convulsive disorders and real attacks of epilepsy. The annals of surgery contain a small number of well observed and very curious cases, which demonstrate the existence of these reflexes. The simplest is undoubtedly the tickling sensation felt by the patients in the fauces or submaxillary region. But the reflex action is not always confined to a sensation ; the salivary glands, especially the submaxillary on the corresponding side, secrete a much larger quantity of saliva than in the normal condition. Power, who is quoted by Itard, saw a patient in whom the quantity of saliva excreted in the twenty-four hours reached two and a half pints. In another case, tampons of cotton incrusted with cerumen produced analogous effects for two years. Latour saw a patient recover from this annoyance after the extraction of a foreign body of the ear.

Observation.—Earwig in the auditory canal.—Salivary symptoms.—Extraction by injections.—In 1834, a farm-hand, eighteen years old, asked me to rid him of an insect which had entered his left ear while he was asleep. The animal caused him intense pain, for, he said, it bit and pricked him incessantly. The young man shed tears profusely, streams of stringy saliva flowed from his mouth, and he uttered harrowing cries. Half of the head and face were tender, and the least concussion was felt in the ear, which the patient pressed upon with his left hand. It was nearly dark, and I had no speculum auris. The straightening of the auditory canal, by means of tractions on the concha, did not enable me to determine the presence of the foreign body. But, being especially desirous of relieving the pain, I took a small syringe and made several injections of olive oil into the auditory canal. At the end of a few moments I saw an ear-wig of moderate size make its appearance, and succeeded in removing it with a dissection forceps. The pains disappeared immediately, and on the next day the young man resumed his usual work. (Rec. de mém. de méd. mil., 1846.)

These cases are not very rare, and a very large number were observed after attention was drawn to this point. It would not be to the purpose to insist now upon the mechanism by which these reflexes are produced; it is certain that the proximity of the chorda tympani and of the other nerves of the ear is not indifferent with regard to their appearance, and physiology can now explain these phenomena. Authors have long regarded the anastomotic branch, which passes from the ear to the plexus

[1] Thèse de Paris, 1873.

[2] Arch. gén. de méd., 1878.

gangliformis of the pneumogastric, as the origin of the various symptoms observed on the part of the chest and stomach. Not only have cough and vomiting been known to coincide with the existence of a body in the ear, but, in some cases, these reflex disorders were apparently the sole manifestations of the foreign body. "Arnold speaks, according to Dr. Zeller, of a patient who had been subjected for some time to internal treatment, and in whom a foreign body was discovered by chance in the external auditory canal. Its extraction put an end to the supposed thoracic affection, which had resisted all the remedies employed. The same author copies from Martin the history of a little girl who was affected, for a long time, with a violent cough, expectoration, frequent vomiting, and progressive emaciation. Upon examining her with great care, a bean was found in each ear, which had probably been introduced a long time previously during play, and were removed with difficulty. The extraction of these bodies gave rise to severe cough and profuse vomiting, but it was followed by a complete restoration to health."[1]

Toynbee also reports the case of a patient suffering from a violent, incurable cough, which ceased immediately after the removal of a piece of necrosed bone from the auditory canal. Among 75 cases of foreign bodies of the ear collected by Mayer of Munich,[2] cough and vomiting were observed in five instances. Itard observed spasmodic dysphagia in a cook who had a grain of oatmeal in his ear. The examples of epilepsy related by authors belong to the same category, but as this symptom does not occur primarily and only after a certain length of time, it is more natural to class it with the secondary phenomena. Heydenreich has very recently published a case of reflex hemicrania produced by the presence of a foreign body.[3]

Phenomena of Compression.—When the foreign bodies are somewhat large they also produce very serious disturbances by the pressure which they exercise upon the inextensible walls of the canal, or upon the membrana tympani itself. In the canal it produces various phenomena, according as the body is regular, spherical, pointed, of a firm or soft consistence. If the body is regular the effects of the pressure are confined to an increase of the pain, which becomes throbbing and more severe than usual. After a short time it becomes lancinating, and extends not only to the temporal region, but also to the entire head—sometimes assuming the form of well-marked hemicrania. If the bodies are hygrometric, like cherry-pits, all the symptoms increase in intensity, paralysis is superadded to the neuralgia, and the affection assumes a severe character. However, the physician rarely observes such serious symptoms from the beginning, when the membrana tympani is intact. When the latter, on the contrary, becomes compressed by the foreign body, as happens when reckless attempts at extraction have pushed the object to the bottom of the canal, the symptoms change. Roaring in the ears, cephalalgia, and vertigo are then present. Surgeons have been impressed by these symptoms, and Toynbee was one of the first who gave a satisfactory explanation of the vertigo.

According to him, the pressure which the foreign body exercises on the membrana tympani is transmitted to the chain of bones; the base of the stirrup is then pushed into the fenestra ovale, producing a disturb-

[1] Itard: Maladies de l'oreille, p. 307.
[2] Monatsschr. f. Ohrenheilk., IV., 1-5, 1870.
[3] Brit. Med. Journ., 1878.

ance in the equilibrium of the fluid of the labyrinth. It is evident, in fact, that the ordinary conditions are very markedly changed by the presence of the foreign body, and, in default of another explanation, we must adopt that given by Toynbee.

The eccentric pressure exercised by a solid and regular body in the osseous portion of the canal has more than once produced disorders on the part of the facial nerve. Several authors speak of facial paralysis, which appeared shortly after the accident. Mayer has collected five cases of lesions of the facial nerve.

If the body is irregular, the excentric pressure will be followed by primary lesions of the walls or membrana tympani. This results in wounds or perforations which constitute complications, and will be studied somewhat later.

CHAPTER V.

SECONDARY SYMPTOMS.—COMPLICATIONS.

When they are present, the secondary symptoms follow the preceding ones, or perhaps appear first after a longer or shorter period of indolence. Some are merely an exaggeration of the primary symptoms due to the presence or mechanical action of the foreign bodies. Others, of inflammatory origin, result from otitis and otorrhœa, which do not always remain circumscribed. Finally, the pressure effects may extend to the adjacent organs, and severe cerebral symptoms sometimes result from the prolonged detention of the object. I shall study, in a special paragraph, the lesions and symptoms produced by bodies which are sharp or are pushed in forcibly, cause perforation of the mucous membrane of the canal or tympanum, and remain in the cavity of the middle ear.

The initial functional disorders continue, but the subjective symptoms are often modified. Sometimes, after a period of suffering varying from a few hours to several days, the pain subsides, sometimes it continues, on the contrary, and becomes the first symptoms of inflammation—the most frequent and serious complication of foreign bodies of the ear.

Inflammatory Symptoms.—The persistence and exacerbation of the pain are accompanied by a swelling which soon attacks the entire canal, which is markedly narrowed, red, tense, and very sensitive to pressure. The patient feels an intense heat in the part. At the same time the general condition, which had hitherto not been involved, becomes affected. The patient has chills, continuous headache, anorexia, and a condition of undefinable malaise, terminating in high fever. All these symptoms develop within a few days, and we soon notice a discharge from the auditory meatus, which is at first serous, but then thickens and becomes purulent. The external otitis passes on to suppuration. While these changes are occurring in the local condition, the general symptoms do not subside to any appreciable degree, because the cause persists, and the inflammation of the canal is essentially prolonged and rebellious. The discharge from the ear gradually increases while the general symptoms diminish, and this is characteristic of the passage of the process from an acute to a chronic stage. The affection is usually observed by the surgeon

under this form. Mayer noted suppuration of the canal and otitis fifteen times in seventy-seven cases. As soon as suppuration is established it gradually becomes thinner without losing the ordinary qualities of pus of the auditory canal, which is remarkable for its fœtid character and rapid decomposition.

Locally, a very marked swelling is produced; the mucous membrane soon forms a ridge in front and behind the foreign body, which is thus enclosed, and so much the more firmly, because, on account of its nature, the latter is capable of swelling and increasing its volume. The somewhat prolonged pressure gives rise to the formation of ulcerations, which are either partial or occupy the entire circumference of the canal. Mayer has noted these ulcerations of the canal five times. Hitherto I have not taken the position of the body into consideration, but, when there is a certain free space between the membrana tympani and the body, the suppuration of this inflamed portion cannot make its way to the outside, resulting in an aggravation of the symptoms and excessive pain. As Desprès has remarked, the pain sometimes ceases suddenly, although we are unable to explain it, and though no change occurs in the position of the body. The tension is markedly diminished in these cases by the rupture of the tympanum.

These inflammatory symptoms may terminate in two different ways, according as the lesion remains localized, or as it is propagated to the adjacent organs and parts. In the first case, the suppuration gradually becomes chronic, lasts for years without any notable change, and remains capable of giving rise to more or less serious modifications. The symptoms do not run such a mild course in the second case, and, after a short time, if art does not very soon interfere to arrest the progress of the disease, life may be endangered by the inflammatory complications.

Inflammatory Complications.—The propagation of the inflammation to the membrana tympani, which is the most frequent of all, is almost the rule when the body is situated in its vicinity and its presence is not well tolerated. But it is not always confined to this organ, and it has more than once produced perforation of the tympanum, or purulent otitis media. At other times the pus perforates the petrous portion of the temporal bone, and the inflammation is propagated to the meninges or brain. Literature contains several cases of death either from abscess of the brain or from meningitis, in consequence of the presence of foreign bodies in the ear. Cerebral abscesses are rarer than meningitis, because a previous adhesion of the meninges to one another is necessary to the production of the former. In the classical case reported by Sabatier, a pellet of paper, after having produced an inflammation of the middle ear, had caused necrosis of the upper wall of the cavity of the tympanum. The adhesions formed between the meninges had placed these organs in communication with one another, and an abscess had formed in the tissue and upon the surface of the brain.

Observation.—Wad of paper in the ear.—Abscess of the brain.—Death.—I have seen a pellet of paper produce severe disturbances and cause the death of the patient. It was uncertain whether it had entered the ear, and the examinations which were made on this occasion were so unmethodical, that the pellet was pushed in very deep, and it was thought to have merely struck the ear without entering it. The patient continued to enjoy good health for several months. At the end of this time he was attacked by a malignant, putrid fever, accompanied by violent headache, from which he died on the seventeenth or eighteenth day. I was asked to make an autopsy on the body. The head appeared to me to deserve particular attention. There seemed to be no change in the brain, but, after it had been raised from the base of the skull, I noticed that the

portion of the organ which rested on the upper part of the petrous portion of the left temporal bone had contracted firm adhesions with the dura mater. In the vicinity of this adhesion there was a small abscess, the pus of which escaped into the cavity of the tympanum, through an opening which had formed in the temporal bone. The wad of paper was in this cavity, into which it had penetrated after having destroyed the tympanum; it was covered with pus. The assistants as well as myself were convinced that the wad of paper had produced the lesion which we had observed. (Médecine opératoire, T. IV., p. 48.)

When meningitis develops, it does not declare itself frankly, and it is only after a very long period that the first grave symptoms become manifest. In the period which separates the introduction of the body from the appearance of these symptoms, the ear is the seat of a very acute inflammation, which may yield to proper treatment. But this improvement is only temporary, as the pains in the head increase, and fever and delirium then develop, with the characteristic symptoms of meningitis, small and frequent pulse, strabismus, muttering, etc. Therefore, when we find the cephalalgia increasing during the course of an otitis produced by the persistent presence of a foreign body, we should think of the possibility of this grave complication, and do everything possible in order to prevent its development. The following illustration is interesting in several particulars.

Observation.—Sweet-pod pit in the ear.—Meningitis.—Extraction.—Death.—A boy, aged six years, had introduced the pit of a sweet-pod in each ear. On the following day some incompetent persons made vain attempts to extract the pit from the left ear, and produced pain and hemorrhage. (The pit in the right ear made its exit spontaneously). In the afternoon the author found the auditory canal very red and excoriated, and the pit was firmly embedded and covered with blood, at the bottom of the canal. Injections continued for a long time were of no avail. The untractableness of the patient, increased by the violent manipulations which had been previously attempted upon him, rendered the use of instruments impossible. Despite venesection of the tragus, there was such a swelling of the auditory canal and anterior auditory region on the following day, that inspection of the deeper parts was no longer possible. The pains yielded somewhat to antiphlogistic treatment, but the swelling only disappeared slowly, and the pit could not be seen again until the end of three weeks. During this time the patient, although complaining of occipital pains, and having fever from time to time, did not do poorly. However, violent fever, intense cephalalgia and delirium, suddenly supervened. Despite the persistent swelling of the auditory canal, an attempt was made to remove the foreign body. As the patient violently resisted every attempt at extraction, he was slightly anæsthetized with chloroform, an ear-pick was then introduced into the properly lighted auditory canal, and plunged into the black surface which was observed at the bottom. On attempting to extract the pit, only the softened pulp was removed. The concavity of the ear-pick was employed to remove the hollowed rind, and its extraction was readily performed. Although tripled in size, it still had a certain consistence; unfortunately the symptoms of meningitis increased, coma developed three days after the operation, and death occurred on the following day. (Schmidt's Jahrb.: 1800, T. CXLVIII., p. 230.)

This case is not unique in literature, and Mayer found in seventy-five cases that death was due in three to meningitis.

Secondary Accidents in the Vicinity and Reflex Disorders.—The inflammatory symptoms are not the only ones produced by the prolonged stay of foreign bodies in the ear. There are others which are due to the persistent irritation produced by the object upon the mucous membrane of the canal, or that of the tympanum. I have already had occasion to draw attention to this variety of accidents in speaking of the primary symptoms. Those which are now referred to only appear, as a rule, after a certain length of time, the first period having been characterized either by indolence or the primary disorders having subsided. They include all

the nervous disorders of sensation or motion affecting the vicinity, which appear under various forms, such as anæsthesia, paralysis, neuralgia, contractures, or convulsions. Several individuals, who have foreign bodies in the ear, have become epileptic. No doubt can be entertained upon this question of pathology, as extraction sufficed to cause disappearance of the attacks. I will now mention a few of these cases. Wilde,[1] quoted by Duplay, reports the history of an epileptic who was deaf in consequence of the presence of a foreign body in the ear; its extraction caused the disappearance both of the deafness and of the epileptic attacks.

Every one knows the history of Fabrice of Hilden's case, in which the strangest nervous symptoms were produced by the presence of a glass bead.

Observation.—Glass bead in the ear.—Neuralgia.—Epilepsy.—A girl ten years old was playing with some children of her own age, when one of them threw a glass bead as large as a pea into her left auditory canal. The attempts made by various surgeons to remove this object only served to push it in still farther. The pain, caused by its presence and the fruitless attempts to remove it disappeared, but it was followed by a very sharp pain on the side of the head as far as the sagittal suture, which increased in damp weather. Numbness of the arms, loins, thigh, and left leg supervened, so that these portions of the body were in a condition of stupor; this numbness gave way to sharp pains in the same regions. A dry and continual cough was added to these symptoms; the menses only appeared once in three months and in small quantity. Finally, after suffering for five or six years, the patient had attacks of epilepsy and the left arm became atrophied. The mother consulted many physicians, without speaking of the foreign body in the ear, because her child no longer felt any pain in this region. But Fabrice finally discovered this fact, extracted the body, and cured the patient.

Observation.—Centipede in the ear.—Grave nervous symptoms.—Expulsion.—Recovery.—A child, four months old, of a good constitution, was brought to the Cochin Hospital, June 20, 1860. The mother stated that he had been vomiting continually for a month past, and that he suffered from convulsions, which were repeated several times a day. On the following morning, in fact, the child had an attack presenting all the characteristics of an epileptiform convulsion; several similar attacks occurred during the day. In the intervals of rest, sensation and motion appeared equally well preserved on both sides. Auscultation showed no thoracic lesion. As everything appeared to indicate a cerebral affection—tubercular meningitis, for example—the treatment was ordered accordingly (oxide of zinc and belladonna). This treatment appeared to modify the convulsive condition at once. However, on June 24th, a considerable dilatation of the pupils was observed, with paresis of the right hand, abundant discharge of sanguinolent, sero-purulent matter from the right ear—a discharge which had lasted about a month, and which was not mentioned by the mother in the first few days. Emollient injections. On the 26th, two convulsive attacks. In the morning the side was paralyzed; sensation and motion completely lost both in the face and limbs. There was some improvement in the next few days. On the 30th, severe vomiting reappeared and a blister was applied to the pit of the stomach. Notable improvement in the beginning of July; then the convulsions and vomiting reappeared until July 19th. On this day, while making an injection in the ear, the mother saw a black body appear, and, with a pin, extracted an insect 2–5 centimetres long. It was a centipede of the class of myriapodes. The child's health was soon restored. (Gaz. des hôpitaux, Oct., 1860.)

Accidents caused by Foreign Bodies which have wounded the Walls or the Tympanum.—The symptoms of irregular foreign bodies deserve special mention on account of their gravity. In fact, they frequently produce lesions of the canal or membrana tympani. As examples, I will mention pins and needles which are broken in the ear, the grains of oat which are imbedded into the walls, or even into the tympanum, as

[1] Aural Surgery, p. 321.

in the case quoted by Belbeder;[1] moreover, molten lead, which at once perforates the tympanum, and becomes solidified in the cavity of the middle ear. Is it not evident that these cases possess far greater gravity than those in which the bodies are arrested in the canal?

Side by side with these cases, which refer to a particular class of bodies, I will range those due to inconsiderate manipulations on the part of the patients or physicians, which very frequently transform a simple case into a complicated one. Thus, among the seventy-seven cases collected by Mayer, the tympanum was pierced thirteen times, either by the foreign body or the operative manipulations.

When the presence of the foreign body is complicated by a perforation of the wall or tympanum, we must expect to find that the inflammatory symptoms assume a greater intensity. We do not imply that inflammation is an inevitable consequence, as the tympanum has been found perforated by a foreign body and has cicatrized without any trouble. But cases of this kind are very rare, and we must not rely upon so great a tolerance as was observed in the following example:

Observation.—Eyelet of a corset in the middle ear.—Tolerance.—A child, three years old, who had been suffering for a long time from obstinate bilateral otorrhœa, introduced the eyelet of a corset into the ear. The violent attempts at removal were unsuccessful. The ring was situated in such a way that the opening looked upward and inward, being enclosed between the promontory and the posterior wall of the cavity of the middle ear. Although the most varied instruments could be pushed into the ring, it was impossible to make it budge. The ring remained for weeks and did not produce any symptoms. For this reason all further attempts at extraction were abandoned, and, at the end of nine months, the child was still free from any bad results. (Bartscher: J. f. Kinderk., 1863, XI., p. 17.)

As in foreign bodies of the canal, the symptoms which develop in cases of perforation are of two classes: some are remote disorders secondary to the irritation; the others result from inflammation of the auditory canal, membrana tympani, and middle ear. But in the present case the symptoms begin much more rapidly, almost in the beginning, and may even carry off the patient in a few days. A grain of oat entered the ear of a man observed by Belbeder, and caused death within a very short time, in consequence of epileptic convulsions. The grain of oat had produced perforation of the tympanum, and, as a curious fact, the convulsions were more marked on the right side, although the foreign body was situated on the left.

In the majority of cases the sufferings increase very markedly, so that the patients absolutely refuse to allow the part to be touched. Simple contact with the foreign body, which was imbedded in the wall, has been known to immediately produce convulsions and very violent pains. "I have seen," says Itard, "a young girl who was attacked with fever, convulsions, and intense otitis, in consequence of the presence of a very fine sewing-needle in the ear." The inflammatory symptoms frequently appear at the same time as the preceding, and they may then attain great severity. I will quote as an illustration the history of the man who had molten lead poured into the ear.

Observation.—Molten lead in the ear.—Various symptoms.—"On the 22d of June, 1874, a man, aged 55 years, was lying on a sofa with his eyes closed, when his wife poured some molten lead into his right ear. On his admission to the hospital, three

[1] Journ. de santé, Vol. I.

days later, a deep burn of the concha and external auditory canal was observed, with an abundant discharge from the ear. A barely perceptible shred of the membrana tympani was left, behind which the ear was filled with a mass of shining metal. This had two prolongations; one outside, the other behind the meatus. A portion of the handle of the hammer was discernible in front of the foreign body. Right facial paralysis; for two or three minutes after the accident, the patient noticed loss of taste and dryness of the mouth on the right side. No difficulty in deglutition, but deviation of the uvula to the left side, with constant, rotatory vertigo. The tuning-fork placed between the teeth is heard only on the left side. The foreign body could not be extracted until February 23, 1875, eight months after the accident; it weighed eighteen and a half grains. The handle of the hammer was contained in its outer portion. The external surface was perfectly moulded to the inner wall of the cavity of the tympanum. A cylindrical prolongation of the anterior portion, two millimetres in length, represented the highest portion of the Eustachian tube. Toward the end of April the wound in the ear was cicatrized, but there was persistence of the facial paralysis, the loss of taste and dryness of mouth on the right side, and of the deafness on the same side. Vertigo was also present." (The Amer. Journ. of Med. Sciences, 1875, p. 132.)

It is very curious to find that life was preserved in a case so severe as the preceding, especially if we compare it with others, in which small foreign bodies, like oats or needles, have caused very grave symptoms and death. Fleury of Clermont published a case of this kind, terminating in very acute meningitis, which carried off the patient only five days after the introduction of the body. This is an extremely striking example of the gravity of irregular and perforating foreign bodies.

Observation.—Pin in the ear.—Meningitis.—Death at the end of five days (*Résumé*). —"A woman, twenty-five years old, consulted Fleury with regard to a pin which had broken in her right ear two days previously. The attempts at removal made by some laymen and by a physician proved useless, and only succeeded in forcing its two ends into the walls of the canal. The pin was directed transversely, and the middle portion rested against the membrana tympani. As soon as it was touched the patient gave utterance to cries, and experienced intense pains. On the 3d day she was anæsthetized; but it was impossible to perform extraction with the forceps because the blades could not be opened on account of the swelling; a hook also failed. While a special instrument was being constructed, the pains in the head kept on increasing, but no fever developed. Compresses soaked in chloroform and balsam were applied to the forehead and temples, but they produced no improvement. On the morning of the fifth day the headache had not lost its severity, and the pulse had become frequent. Fearing meningitis, Fleury prescribed the application of leeches behind the ears, to be renewed every two hours. Blister to the legs, calomel internally in divided doses. The leeches had hardly taken hold when the patient lost consciousness; the face became congested, respiration accelerated, contracture of the right arm developed, and she died at six o'clock in the evening." (Gaz. des hôpitaux, 1870, p. 58.)

CHAPTER VI.

THE FATE OF FOREIGN BODIES.—TERMINATIONS.

The foreign bodies which are introduced into the ear and left to themselves may undergo various changes, almost all of which belong to one of the four following conditions:

1. Tolerance.
2. Spontaneous expulsion.
3. They may remain and produce persistent functional or organic disorders.
4. They may terminate in death.

1. Tolerance of Foreign Bodies of the Ear.—I have previously had occasion to remark that there was no complete tolerance, and that under this title we were accustomed to class a certain number of cases in which the simple diminution of the auditory function did not attract the attention of the patients. It is so marked that fourteen years have elapsed without a suspicion on the part of the individual that a bead or some body of this sort was situated in the ear. Tolerance is rarely established immediately, especially when the introduction of the foreign body is an accidental occurrence capable of attracting attention and of irritating the mucous membrane of the canal. But this is not so if the body is less irritating, if it passes unnoticed, like the little plugs of cotton which some persons wear with religious care. At other times, the initial symptoms follow their regular course, have their period of increase, and then gradually diminish and disappear, to give way to an insignificant hardness of hearing. After this, such a condition of affairs may persist for years, and even during life, unless attention is drawn to this point by chance, or unless, for various reasons, the irritation is renewed. Witness Winterbotham's [1] case, quoted by Colin and Duplay, in which a cherry-pit remained in a man's ear for sixteen years without producing any other symptom than deafness. It was only at the age of seventy years that the body in question was removed by injections. Then follows Marchal de Calvi's case, referring to a cavalry officer who had a bead in his ear for more than forty years, and who suffered from intermittent deafness. A carious molar tooth [2] has been tolerated by the canal for forty years, a milk-tooth for a long number of years, and a cylinder of graphite for eleven years.[3] Rigollot saw a pen which had remained since the seventh year in the ear of a child twelve years old. Bertin removed from the ear a beech-nut introduced fifteen months previously, and which had merely produced deafness. Such cases are not extremely rare in French and foreign medical literature; the bodies are almost always found covered with a layer of hardened cerumen, which isolates them from the mucous membrane, and thus prevents irritation. Moreover, the tolerance is not equal with regard to all bodies; a certain number of conditions favor it, while others oppose it.

The hygrometric power of the majority of regular foreign bodies of organic origin undoubtedly counteracts the tolerance in various ways. In the first place, they are capable of being changed by imbibition, and their successive transformations render them less harmless. Of all these modifications, the swelling is the one which most effectually counteracts the establishment of tolerance. Hence, cherry-pits, seeds and beans, which swell and double in size, almost always produce symptoms. Albucasis, Fabrice of Hilden, and A. Paré recognized this peculiar influence of organic foreign bodies. Not only are the older authors aware of this phenomenon, but they even recognized the fact that cherry-pits may sprout in the canal. This would be proven by Tulpius' case, reprinted by Itard, if its authenticity were sufficiently established.

Observation.—Germination of a cherry-pit in the ear.—"A child, while playing with his comrades, pushed a cherry-pit into his ear, which could not be extracted. After a certain lapse of time a stem sprouted from the pit, and showed itself outside; this was carefully seized in order to remove the pit. Only half of it was removed, the other half remaining inside, and useless attempts being made to seize it. In order to effect this object, it became necessary to make a semilunar incision behind the ear,

[1] Winterbotham: Med. Times and Gazette, 855, 1866.
[2] Algm. Wien. med. Zeit. [3] Preuss. Vereinszeitung, 75, 1862.

because the pain increased to such an extent as to threaten inflammation, and consequently convulsions and death, according to Hippocrates' prognosis."

However this may be, the cases of separation of the pit are not extremely rare; there was then no layer of cerumen around them, while this condition always existed whenever the body was present for a long time. Hence, a dry pea may be tolerated in the ear.

But, apart from these circumstances, we must especially take into consideration the more or less regular shape of the body, and the situation which it occupies. The farther they are removed from the membrana tympani, the better will they be tolerated. This is readily understood if we reflect on the chances of irritation, which are much greater as this organ is approached, and upon the smaller number of ceruminous glands in this portion of the canal.

When tolerance does exist, it is not always indefinite, for a shock or displacement of the body is sufficient to reawaken all the initial symptoms.

All authors who have written on this subject, Tillaux among others, have drawn attention to this practical point, and have shown that the most severe accidents may appear after a very long period of tolerance. A blow, fall, or an intercurrent affection, or even a trivial manipulation, is sufficient to move the body and to push it against the tympanum, which always reacts acutely. In Deleau's case otitis did not occur until two years, and in Ivan's case [1] until five years after the introduction.

What position is occupied by the bodies which are tolerated? Some, being protected by the coat of cerumen which covers them, remain entirely in the canal; while others, especially those which are tolerated in the deeper parts, sometimes hollow out a niche in the mucous membrane. Latour observed a case of this kind. It referred to a grenadier, who had a cherry-pit in his ear which had been well tolerated for a year, and only produced slight deafness. Examination of the ear revealed a tumor in the antero-lateral portion of the canal in front of the tympanum, and which gave a dull sound with the stylet. The diagnosis was doubtful between a sequestrum and a foreign body, as some suppuration had occurred a year previously. Injections of oil were made, which displaced the body and permitted its extraction; the deep excavation in which it had lodged then became visible. This case is interesting, and other analogous ones would undoubtedly be found, if observation was always possible after the extraction of bodies which have been present in the canal for a long time.

2. Spontaneous Expulsion.—Under ordinary circumstances, spontaneous expulsion is a rare phenomenon, which is only observed under two conditions: 1, primarily, including living and other bodies; 2, as an effect of suppuration of the canal.

There is no doubt that insects may enter the canal and emerge spontaneously, as larvæ have been known to develop in its interior and produce worms; they must have been carried there by flies. The other bodies which leave the canal spontaneously include somewhat large objects, which, under the influence of gravitation or of a proper position, approach the meatus and even fall outside. Such cases exist, but we must not base an expectant plan of treatment upon them, because they are veritable curiosities.

Suppuration sometimes occurs around deeply situated bodies, and gradually carries them along with it. Desprès has referred to this mode

[1] Gaz. méd., 1877.

of termination. "When left to themselves, he says, in an ear which is suffering from inflammation and otitis media, the foreign bodies emerge with the pus, sometimes with pieces of necrosed bone; the patient remains deaf." If we examine the writings of authors for illustrations of those modes of termination, we will find that they are very rare, and I have been able to collect only a few.

Observation.—"Fabrice of Hilden relates that a cherry-pit (to remove which vain attempts had been made with a hook, which had pushed it in still farther by tearing the membrane of the canal) presented itself, after a certain length of time, at the entrance to the auditory meatus, bathed in pus, and was removed without difficulty with the point of a pin." (Itard, p. 302.)

Holmes also reports that a pea which he was unable to extract, and which had been left to itself, was carried to the meatus by the suppuration which developed after a short time; it was then readily withdrawn.

In addition to these examples of expulsion through a natural passage, a few other cases have been observed, in which the foreign bodies gave rise to the formation of mastoid or pharyngeal abscesses. Furthermore, Albers observed a case of elimination or expulsion through the Eustachian tube. Although the manner in which the foreign body arrived in the pharynx is unknown, it is none the less certain that it was expelled in this direction.

Observation.—Escape of an aural foreign body through the pharynx.—A young girl, in whose ear a pin had entered, was taken with very violent pains, inflammation, and swelling of the entire corresponding side of the head and neck. This symptom did not cease until the girl passed the needle after taking an emetic, in order to relieve the nausea. (Albers in Loder's J. B. I., p. 151.)

3. Continuance of the Symptoms.—All the initial symptoms may persist so long as the irritating cause continues to act; some are nervous, others inflammatory disturbances. I have several times quoted cases which support this statement, and the inflammatory phenomena very frequently pass into a chronic condition. Hence, the interminable suppurations, especially when the foreign body occupies the middle ear, accompanied by pain, severe auditory disorders, and even vertigo or tinnitus aurium.

Serious changes have been noticed in the membrana tympani or in the canal, even when the phenomena are more simple and the body is tolerated. Thus, Mayer states that the prolonged presence of foreign bodies produced chronic ulcerations five times in seventy-five cases, and polypoid vegetations four times. In another case reported by Porteu,[1] a coffee-bean, which had remained for thirty years in a woman's ear, was only discovered by chance. Hearing remained enfeebled after the extraction of the foreign body, on account of the atrophy of the membrana tympani.

Observation.—Removal of pebbles from the ears.—Chronic changes in the tympana.—In another case taken from the same source, and published by Brown, a large number of small pebbles were extracted from the auditory canals of a youth sixteen years old, almost deaf and quite weak-minded; these had been present for seven years. Thirteen were removed from the left ear, and fifteen from the right. Apart from a considerable enlargement of the auditory canal, Brown found the tympana retracted, and, especially on the left side, in a condition of softening. In some places they were atrophied, in others thickened, giving them a marbled appearance. The auditory

[1] Schmidt's Jahrb., 1876, T. CLXX., p. 82.

faculty improved considerably, and the intellectual condition of the young man was also raised in a perfectly satisfactory manner. (Schmidt's Jahrb., 1876, p. 82, T. 170.)

4. Death from Foreign Bodies in the Ear.—Death is rarely primary, but it has been known to occur within a few days in cases of irregular and perforating foreign bodies. Belbeder's patient died on the second day in the midst of convulsions, and Fleury's succumbed to a meningitis on the fifth day. It usually occurs later in cases of foreign bodies; it then results from a progressive propagation of inflammation to the meninges or brain. Mayer found suppurating meningitis three times in four fatal cases, although this termination is very rare. We cannot admit, with Sir James Patterson Cassels, that there is no case which clearly proves that foreign bodies in the auditory canal may prove fatal.

CHAPTER VII.

PROGNOSIS AND DIAGNOSIS.

1. Prognosis.—We may conclude, from the preceding remarks, that all foreign bodies do not possess the same gravity. Some, which are irregular, are accompanied by much more acute pains, and rapidly produce accidents, which are so much more serious if they have perforated the membrana tympani or the walls of the canal. Others are regular, and are not really dangerous, unless they are situated at the bottom of the canal, and unless, by their hygrometric properties, they are capable of increasing in size. But we must also take into consideration the nature of the body, the extremely variable irritability of the auditory canal, and many of the useless or heedless manipulations which are made by first comers. In the majority of cases they aggravate the prognosis, in consequence of the lesions which they produce. We may also state that the prognosis is less grave when the patient immediately seeks assistance, than when attempts at removal have already been made. The cases published in the course of this article abundantly demonstrate this fact. Finally, animate foreign bodies always produce grave accidents, and Triquet considers their prognosis as very serious.

In conclusion, I will furnish a résumé of our knowledge regarding prognosis by making an analysis of Mayer's statistics,[1] which are based on 75 cases collected in the medical literature of the last fifty years.

"The tympanum was wounded 13 times by the foreign bodies or by operative manipulations; an abundant hemorrhage was observed 5 times after these attempts at extraction; violent pains in the ear alone, or in the ear and head, 3 times. Inflammation developed 13 times, 10 times with considerable swelling of the auditory canal. Termination in suppuration was noticed 15 times; once there was a considerable discharge of serum; 5 times ulcerations of the auditory canal; 4 times the formation of polypoid vegetations.

"Cough and vomiting were observed 5 times, and in 5 cases there was

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[1] Monatsschr. f. Ohrenheilk., IV., 1–5, 1870.

a lesion of the facial; general convulsions in 3, atrophy of the arm in 2, anæsthesia of half the body in 2, epilepsy in 2; among 4 fatal cases, death occurred in 3 from suppurative meningitis, and in 1 from abscess of the brain."

2. Diagnosis.—It is absolutely necessary that the diagnosis of foreign bodies of the ear should be made with the greatest precision, as it serves as a basis for manipulations of extraction, and every mistake is extremely prejudicial to the patients. Not alone the existence or absence of a body must be carefully determined, but the physician must also be informed with regard to its shape, exact and relative position, its dimensions, etc. Any omission of these precepts may lead to cruel mistakes, and the slightest error may exert considerable influence. If I insist so strongly upon the necessity of a rigorous diagnosis, it is because literature contains heartrending accounts of the most lamentable mistakes and the most serious errors, committed by laymen, or even by too credulous or inexperienced physicians.

The data necessary to make a diagnosis are collected from four sources: the history, the functional disorders, exploration by sight, or exploration by touch.

1. *History.*—It is hardly necessary to state that this is very useful when exact, as it draws attention to the organ affected and saves valuable time. It is usually furnished by the patients themselves, or by the relatives when the case refers to children of a tender age. The physician should, as far as possible, figure to himself a body like the one which has been introduced, and, if necessary, should make a drawing of it. When the cause of its introduction is accidental, the clinical history is very valuable; but it is often wanting, and may even lead the physician into error. If the relatives have not seen the child introduce the body, they do not know positively whether the entrance has occurred, and especially in which ear the *corpus delictum* is situated. It has even happened that the object has been reported to have entered the opposite side. Finally, the existence of the foreign body is very frequently unknown to the patients, and they express great astonishment at finding pits, coffee-beans, beads, etc., of the presence of which they were ignorant, removed from the canal.

If there is no clinical history, we must not give up the diagnosis, but must pass on to other methods of examination. When an account of the case is given, we should lend faith to it and then gauge its value by a careful examination of the ear. In this manner we avoid making manipulations which are useless in simple accidents, and dangerous in others. Giraldés mentions a case in which the relatives and the child did not know in which ear the foreign body was, and a physician had fruitlessly made several manipulations in the healthy ear.[1] In the following case, Lowenberg succeeded, thanks to a careful examination, in correcting erroneous data by an exploration of both canals.

Observation.—Chemise-button in the ear.—Wrong history.—A chemise-button had been introduced into the left ear of a child five years old, and was discovered only by chance. When Lowenberg saw him, he was complaining of his right ear. He discovered nothing, and when, according to his habit, he explored the supposed healthy ear, he found the button applied against the tympanum. This fact is explained by the fright and terror of the child after the first manipulations, and which were so great that he presented the right ear to the physician who was first called. This ear then inflamed in consequence of the manipulations which had been made, and thus apparently justified the opinion of the relatives.

[1] Dict. des sciences méd., art. Oreille.

Roosa recommends that too much importance should not be attached to the statements of certain hysterical females, who present a mania for foreign bodies. He has had occasion to observe that their testimony is not convincing.

We must, therefore, attach only a relative importance to the history, and it is always better to submit the data which are furnished to severe criticism. The preceding cases are not rare, and all authors who have written on otology present similar ones.

2. *Functional and subjective disorders.*—None of the functional disorders have an absolute value, and they present nothing characteristic in themselves. At the most, they serve to confirm or disprove the conclusions drawn from the history, because there is no example of a foreign body which does not produce some disturbance of audition. But there are numerous gradations between complete deafness and slight disturbance, such as occurs with very narrow and long bodies which do not sensibly interfere with the passage of the waves of sound, so that the sharpness of hearing possesses only a moderate value. However, as this examination is harmless, it may be made, and we may use the watch for this purpose, as Desprès advises.

The existence of a very acute pain, developing suddenly and during sleep, is much more important, because, of all aural affections, it is only the presence of foreign bodies which produces this peculiar, intolerable, increasing, exciting pain, which is observed with the greatest intensity in cases of insects and irregular, perforating bodies. (Colin, Bourgeois.) When added to others, this sign possesses a certain value.

3. *Exploration by sight.*—Examination with light includes two methods: the one consists in allowing the luminous rays to fall into the ear; in the other, resort is had to otoscopes and instruments which facilitate the illumination of the canal. In the first case we must place the patient near a window in the day-time, care being taken to straighten the curve of the canal; to do this, the hand carries the pinna of the ear upward and backward. In order to thoroughly understand the necessity and efficacy of this manipulation, we must remember that the canal presents several curves, of which there are two principal ones. The first one is vertical, with the concavity downward; traction of the ear upward causes this to disappear. The other, situated in the transverse axis, represents, according to Tillaux, "a capital S, whose outer curve is concave forward and is very marked, while the inner curve is concave backward and is less marked than the first." This horizontal deviation is corrected by pulling the pinna backward. Despite its simplicity, this method is very rarely applicable, because it is very difficult to look down the entire canal, especially if the foreign body has been present for a certain length of time; the mucous membrane is then swollen, and the meatus very narrow. Desprès believes that a visual examination, either with or without a speculum, is unnecessary.

Exploration with the aid of various otoscopes is a method which is much more frequently employed. For this purpose we may, with advantage, employ either Toynbee's or Brunton's otoscope or the ophthalmoscopic mirror. We may then either use sunlight or artificial light, preferably the latter; Tillaux prefers reflected sunlight. We must adopt the precaution of straightening the curves of the canal, as previously referred to. This exploration, when possible, is very simple, and is better than all other methods of investigation in furnishing information with regard to the presence or absence, color, shape, irregularities and position

of the foreign body. Unfortunately this plan is not always applicable, either because the hyperæsthesia of the canal prevents it, or because the latter is swollen to such an extent as not to permit the introduction of instruments. We must especially avoid making the mucous membrane bleed during these manipulations. If the first examination is unsuccessful

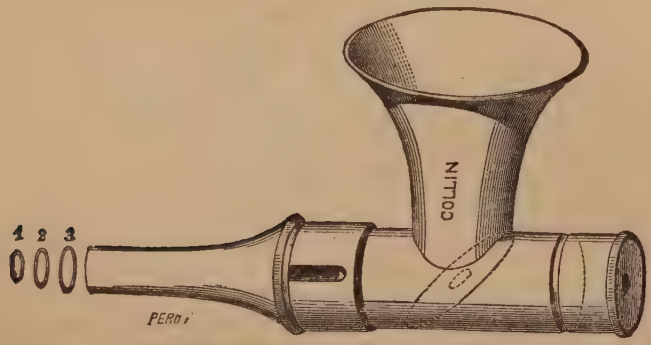

FIG. 88.—Brunton's otoscope (Collin's model).

on account of the presence of dried blood in the canal, or the accumulation of cerumen, we should remove this annoyance by making detergent injections into the ear.

4. *Exploration by the touch.*—I have placed exploration by touch last, because it should never precede the other methods of examination, but should corroborate them. It is evident that touch must be performed by means of special instruments, such as blunt, tapering, and very narrow stylets. Bourgeois conceived the happy idea of graduating them in order to obtain more accurate ideas concerning the situation of the foreign body. Touch without illumination is a dangerous measure, which should be resorted to only in extreme cases, when, for example, illumination is impossible. The observer should use great caution in all cases, should introduce the previously oiled instrument with great care, and, when the foreign body is reached, should avoid exercising any pressure which might push it in still farther. But, I repeat, touch in itself is a bad plan, very uncertain, and often dangerous. Moreover, it has led the surgeon into error on more than one occasion. Thus, Gosselin [1] mistook an eburnated exostosis of the auditory canal for a foreign body. In this case, the appearances and the signs furnished by touch explained this mistake, which was only recognized after attempts at extraction, which were of course useless, and after a more careful examination. Giraldès also referred, in 1868, to the mistakes which the sensation of the denuded wall may lead to.[2] Sir William Jenner has also insisted upon this point in the diagnosis of foreign bodies of the ear.[3] He was called to attend a child whose parents stated that a pebble had entered his ear; a stylet which was introduced gave a sensation of peculiar, well-marked shock. The surgeon recognized that the circumference of the denuded tympanum gave rise to the deceptive shock.

FIG. 89.—Bourgeois' graduated stylet.

[1] Gaz. des hopitaux, Feb., 1851.
[2] Societé de chirurgie, 1868, p. 185.
[3] The Lancet, 1871, T. I., p. 646.

In conclusion, we should always make the diagnosis with care, and verify the history, if there is any; we should explore by means of sight and touch with regard to the mobility or fixation of the body, and the opportunities for this or that method of treatment, according as the body is situated more or less deeply, is large, according as the stylet may be introduced between it and the wall, etc. All these considerations possess great importance. We must, also, not omit taking an exact measurement of the distance which separates the body from the meatus, for not only does this inform us with regard to the situation of the body, but the introduction of the instruments then becomes more precise, and we are better informed with regard to the possibility of introducing them behind the object without running the risk of wounding the tympanum. The surgeon should therefore endeavor to determine the length of the canal, which measures, on the average, 30–33 millimetres in the adult. As Bourgeois has well remarked, it would be very useful to know the variations of this measurement at different ages, every five years for example, as it is impossible to introduce retropulsive instruments, in children, beyond 22–25 millimetres, without running the risk of wounding the tympanum.

I will also quote, as an error to be avoided, the unfortunate history reported by Velpeau,[1] and another similar observation.

Observation.—Attempts at extraction in the healthy ear.—"A frightened woman brought her child, aged 5 years, to one of the public consultations in the Capital, in order to have a cherry-pit removed which had been in the ear for twenty-four hours. Attempts of all kinds were repeated without effect for three successive mornings, and gave rise to severe pain, inflammation, fever. When, after nothing more dared be done, the idea was hit upon of determining whether the ear really contained the cherry-pit, it was found that nothing was present."

Observation.—Supposed foreign body —Attempts at extraction.—Death an hour and a half afterward from hemorrhage.—A little girl, six and a half years old, was brought to a physician in order to have a bead, which was supposed to have entered the ear, extracted from that organ. Fruitless endeavors were made for half an hour, and only resulted in the extraction of a few particles of bone. The physician then dismissed the child, telling the relatives that he hoped everything would go well. The child lost a great deal of blood in the hour and a half during which she waited in an adjacent room, and died from an attack of syncope.

The physicians who were directed to hold an inquest found, at the autopsy, a laceration of the entire length of the canal and of the osseous cells. Debris of bone was also found, but no foreign body; there was a lesion of the mastoid process. The experts did not give a very clear opinion, before the jury, with regard to the cause of death. (Brit. Med. Journ., 1877.)

On another occasion the tympanum was perforated in an analogous case, and the foreign body could not be discovered (Dalby,[2] Demarquay.[3]) We should, therefore, make an exploration, and abstain from further manipulations, if the diagnosis is not sufficiently positive.

In conclusion, the reader will not peruse without interest a recital of the terrible disaster into which the absence of a diagnosis may lead certain individuals, who are so injudicious that they become dangerous. I reproduce from Roosa the following truly astonishing case, which may serve as an example.

Observation. — Imprudent manipulations in extraction. — Absence of diagnosis.—Death.—"Pilcher, in his work on diseases of the ear, reports a very interesting case,

[1] Médecine opératoire. T. III., p. 623.
[2] Dalby: Lancet, 1875, T. II., p. 447.
[3] Demarquay: Soc. de chirurgie, 1868.

in which we find that a surgeon in a London hospital attempted to remove a nail, which he had never seen, but only felt with the sound, from the ear of a child seven years old. The first physician said that he had seen the head of the nail, but had not attempted to withdraw it because four men were not sufficient to hold the child's head. Others then made use of forceps and hooks, without being able to remove it. An incision was then made behind the ear and the meatus laid bare. Search was then made for the nail with forceps and an elevator. With these delicate instruments the operator withdrew three pieces of metal, which appeared to be fragments of the nail. They also removed the hammer. The patient was so weak after these manipulations that the pulse was scarcely perceptible, and the skin was covered with a cold sweat. The operator admitted that he had been obliged to make stronger tractions than were proper. He thought, however, that, as there was a large opening through which pus could escape, there would be some chance of avoiding meningitis, or the cerebral abscess which might develop. The child died two or three days afterward. Changes were found at the base of the brain and anterior lobe. No trace remained of the bony part of the external auditory canal, which had been removed during the operation. The membrana tympani was also absent; there was considerable pus in the cavity of the middle ear. Sections were made through the cochlea, the vestibule, semicircular canals and mastoid cells, but the nail could not be found." (Treatise on the Ear, Phila., 1843.)

CHAPTER VIII.

TREATMENT.

When the diagnosis has been made, the physician should select the appropriate means of treatment, which will form the subject of this chapter. In the first place there is great embarrassment, because the measures recommended from the most remote times down to the present day are very numerous, and the opinions of surgeons are often contradictory. But it is more important to the practitioner to know the indications to be fulfilled, and the course to pursue in treatment, than the more or less hypothetical utility of instruments which have long fallen into disuse, have been reinvented by modern authors, and the unadvised employment of which often leads to disappointment. I also think that the study of this important question would be facilitated by first discussing the methods of treatment and the various plans which they include, without reference to their utility. In the second part, I will give the indications which the surgeon must fulfil whenever he is confronted by a certain variety of foreign bodies. Finally, I will dwell upon the accidents which may result from bad treatment, and upon the results obtained by the methods of extraction.

1. Method of Treatment.—Extraction is the method of treatment generally adopted, and its indications, as we shall see later, are much more frequent than those of expectancy. A thousand plans have been employed to remove foreign bodies from the ear. If the reader remembers the opinions which I advanced in the general chapter, he will have no difficulty in understanding that the measures of extraction are of two kinds: 1, those which act directly upon the body; 2, those whose object it is to remove them by pushing from within outward. These are not the only resources at the disposal of the surgeon, as they are sometimes insufficient. Thus, it has more than once been necessary to cut, break, or even burn the foreign body whose extraction is impracticable. Hence arises a third variety of methods, which I will combine with the other two and will study concisely.

1. Methods of Direct Extraction.—Contrary to what we might suppose, the number of methods by which it is intended to extract the foreign body directly, without passing behind it, are not very numerous. This is due to the very serious difficulties presented by prehension, and to the dangers to which the use of these instruments exposes the patients, for we must remark that every unsuccessful manipulation aggravates the situation. It is very difficult to seize regular foreign bodies, because the instruments frequently have no hold upon them, or the thickening of the wall opposes them.

Among the plans which have been advised, I will mention extraction : 1, with forceps ; 2, with gimlets or turrels ; 3, with agglutinants ; 4, by aspiration.

1. *Extraction with forceps.*—All forms of forceps may serve for the extraction of foreign bodies of the ear, provided they are sufficiently fine, light and slender. Furthermore, on account of the narrowness of the canal, the blades should be very long, in order to open properly. Bonnafont em-

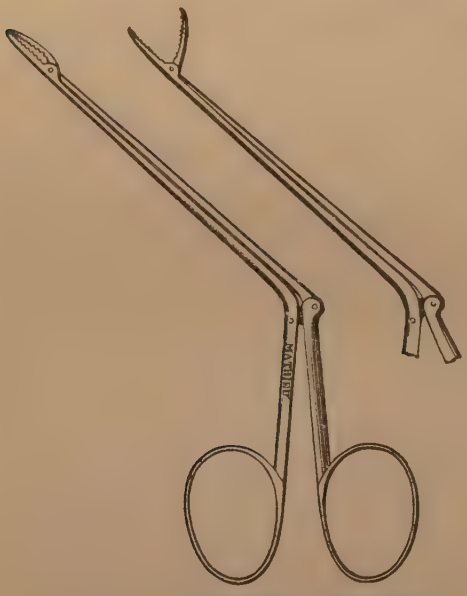

Fig. 90.—Mathieu's forceps for foreign bodies of the ear.

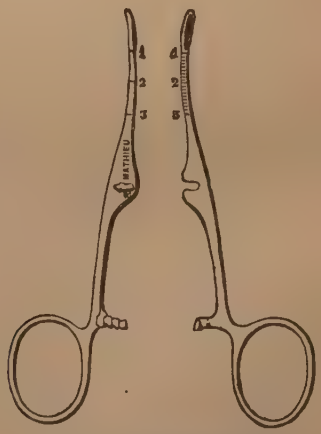

Fig. 91.—Bourgeois' aural forceps.

ploys a dissection-forceps with flat teeth ; others resort to hooked mouse-toothed forceps, some straight, others curved, etc. But all surgeons are unanimous in the opinion that these instruments do not fulfil the object for which they are intended, because it is difficult to pass the two blades simultaneously between the walls and the object, and this attempt very frequently succeeds in pushing the object in still farther when it is small and not fixed. The idea has long been entertained of disarticulating the blades of the forceps, applying them separately, and then readjusting them. The same manipulation is thus effected in the ear as in the application of the obstetric forceps. Passavanti and C. Latour had conceived the idea of the aural forceps, which has been recently perfected by Bour-

geois.[1] The instrument described by this surgeon is "composed of two blades with rings jointed on a pivot. The two blades terminate in thin, narrow spoons. A system of fixation points enables the foreign body which has been seized to be fixed. The instrument measures eleven centimetres, and is graduated between the joint and the tips of the blades." Prior to the invention of this instrument, a foreign author had fenestrated the blades in such a manner as to enable them to fit the foreign body more exactly. Sapolini entirely proscribed all forceps, and the reasons given by him were apparently just: the first blade can be introduced very readily, but the second with great difficulty, "because the handle of the first, and the hand which holds it, interfere." It is, also, often very difficult to join the blades, which are not situated at both ends of the same diameter.

2. *Extraction with gimlets and turrels.*—These methods have been bequeathed to modern surgery by the ancients. Fabrice of Hilden and Paré employed this measure when others failed, and, for this purpose, slightly modified the arrangement of the ordinary turrel. Paré recommended a screw enclosed in a canula; the more complicated and likewise forgotten instrument of Fabrice of Hilden included a turrel and two canulæ. In recent times Bonnafont constructed and employed a turrel, which he screwed into foreign bodies capable of being penetrated, and employed this instrument to remove the object. Deleau employed an instrument similar to a worm-screw, in order to extract a swollen pea. According to Bérard, J. Cloquet succeeded in removing a cherry-pit by means of a narrow and very sharp gimlet. Finally, in a case in which a cherry-pit was solidly fixed in the canal, Dupuytren, after having vainly attempted other methods of extraction, conceived the idea of perforating the pit with Charrière's instrument, and succeeded in extracting it. Langenbeck[2] also devised a small instrument, which is really a miniature turrel. Despite the successes obtained by these methods, they do not deserve much attention, as their use is very limited. In fact, the conditions which must be united in order to permit their employment, viz., fixation of the body, permeability, and a very superficial position, are very rarely realized.

3. *Extraction with agglutinants.*—Like the preceding, the method which consists in withdrawing the foreign bodies with the aid of a sticky substance, is very old. It was used by Albucasis, Paul of Ægina, and by the Latins before them. For a few years past these measures have been again employed by some surgeons.

They vary somewhat, according as the body is large or small. If it is small, it will be sufficient to pour into the ear a pitchy fluid or to coat a small brush with it, which is introduced into the auditory canal by causing it to undergo a slight rotatory movement. Some withdraw the instrument immediately, especially when the objects are small insects, while others allow the sticky substance to thicken *in situ*, and thus adhere better to the foreign body. Bourgeois is opposed to this latter measure, as it exposes the auditory canal to some risks of being wounded at the moment of extraction. If the body is somewhat larger, like a pea, resort has been had to other measures. Thus, Lowenberg[3] succeeded in placing a little brush dipped in carpenter's glue in contact with the foreign body

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[1] Rec. des mém. de méd. milit., T. IX., 1re série.
[2] Berlin. klin. Wochr. 1879, 9.
[3] Bérard: Dict. de chir., art. Oreille.

for a period varying from fifteen minutes to an hour. When he thought that adhesion had occurred, he withdrew both the brush and the pit.

Clarke, quoted by Roosa,[1] resorted to a somewhat different measure: in a case in which the body was a small, hard ball, he passed a wire through a small cube of adhesive plaster, and placed it in contact with the surface of the ball by means of a canula. By means of a lens he then concentrated the solar heat upon the plaster until it had softened and become adherent to the body, which was then readily removed. It is well to know these plans, as they are indicated in some cases.

Fig. 92.—J. Cloquet's stylet.

4. *Extraction by aspiration.*—Even Albucasis had advised aspiration of foreign bodies by means of a metallic canula surrounded by pomade. Latour considers this idea as judicious and capable of application. However, this plan was almost forgotten until it was resumed and somewhat modified by Brown,[2] who advised the application of the end of a rubber tube, through which the aspiration is made, to the foreign body. Aspiration is very rarely indicated, and is replaced to advantage, in these cases, by other measures. I may say the same of extraction with the aid of a leech, a measure which has been employed, but only constitutes a curiosity.

In order to be complete, we must also mention the old plan, which consists in the application of an apple to the ear in order to attract the insects. Velpeau extols the good effects of milk in such cases. I will merely touch upon these questions, which do not possess any very serious interest.

2. Measures of Indirect Extraction.—The imagination of surgeons has been given free play in the invention of a large number of measures and instruments adapted to the removal of foreign bodies by acting upon them from within outward. But they do not all, by any means, possess the same importance and value. In order to bring a little order into their description, I will arrange them in six classes.

1. Stylets; 2, hooks; 3, curettes; 4, rings; 5, curved forceps; 6, injections.

1. *Stylets.*—These instruments are the simplest of all, and are not commonly found at the disposition of the surgeon. Their description is unnecessary; I will confine myself to the statement that the terminal bulb should not be too large. Bowman's stylets, which are used to catheterize the lachrymal passages, may be employed to advantage. J. Cloquet devised a stylet which is somewhat different from the preceding, for, instead of a bulb, it terminates in a ring which forms a sort of small battledore. Stylets act like levers, and require for their employment a free space between the foreign body and the wall. When present, this passage is generally found in the upper and lower parts.

John Cleland,[3] an English physician, has advanced some very original views with regard to the action of stylets or needles employed as extractors. According to him it is not an indifferent matter whether the instrument is placed above or below the foreign body. Opposite effects are obtained in the two cases; when placed below, the body travels toward the meatus; above, toward the tympanum.

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[1] Roosa: Diseases of the Ear, New York, 1876. [2] Med. Times and Gazette, 1868.
[3] The Lancet, 1874. T. II., p. 797.

Observation.—"While I was demonstrator at Glasgow, a student, who was greatly frightened, consulted me with regard to a pea in his auditory canal, and which had been pushed close to the tympanum in consequence of the attempts made by a comrade. It was soon found that there was no room for the introduction of an instrument behind it. I had no other instrument with me but a histologist's needle. I used it in order to attempt to pass behind and above the pea, but in this manipulation the latter turned somewhat and receded. I then determined to place the point of the needle below, and, to my great surprise, I had hardly begun to introduce the point of the needle, when the pea was expelled with violence. Every one can repeat the experiment which I made, with a pea, a tube, and a pin. If the needle is placed above, the pea will move backward for a slight distance; but, in this movement, the needle and pea are displaced in such a manner that the point of the needle continues to act upon the part which was primarily the most elevated but which is now turned somewhat outward, it ceases immediately to act in a vertical direction and pushes the pea toward the tympanum. But, if the point of the needle is placed under the pea, it raises it, and if the needle has been introduced ever so little below, and if the handle of the instrument is lower than the foreign body, the pea tends to roll outside. It is not necessary that the pea be higher than the handle, provided that it can be properly introduced, for, as soon as the handle is lowered, the pea is placed between two inclined planes and escapes with force."

Without discussing the value of this explanation, I will state that we must always, at the moment of extraction, make the handle of the instru-

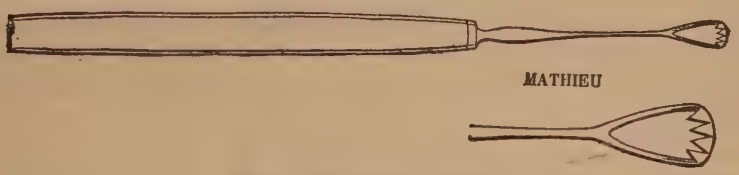

Fig. 93.—Perrin's rake-cystitome.

ment revolve as much as possible in order to avoid pushing the body against the tympanum.

2. *Hooks.*—Various forms of hooks have been employed at all times, and we can hardly understand the persistence of contemporary claims of priority, if we reflect that even Fabrice of Hilden had employed a hook which he passed behind the foreign body in order to withdraw it. Fabrice of Aquapendente also employed an instrument composed of a curette on one side and a curved point on the other. Since the middle

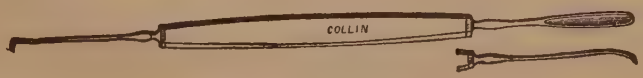

Fig. 94.—Curette-cystitome.

ages this measure has fallen somewhat into disuse, but we find it extolled again in 1864, by Bussières, a Belgian physician. A little later, Lister devised an ear-hook for the same purpose. Finally, in 1873, Delore[1] proposed the employment of a needle curved double in the shape of a hook; this surgeon obtained excellent success with this instrument, which is, at the same time, simple and readily constructed. It is introduced, like all hooks, by sliding the curved portion on the flat between the object and the wall, either above or below, when this is possible. When the operator thinks that he has passed beyond the foreign body, he must make the

[1] Bull. de thérapeutique, 1873, p. 85.

instrument describe a half-revolution, which carries the point behind the object. It then only remains to perform tractions in the proper direction. Finally, I agree with Bourgeois that the employment of the cystitome, and, among others, Prof. Perrin's rake model, will render good service.

3. *Curettes.*—The curettes devised for the extraction of foreign bodies of the ear are very numerous, and are all based on the same principle.

They are composed of two parts, one of which serves as the handle or envelope of the other; the latter is a spring ending in a curette, or a small jointed lever which presents the same shape. In both cases the instrument is introduced like a stylet, between the foreign body and the mucous membrane. The operator then pushes upon the spring of the one instru-

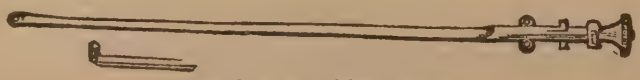

Fig. 95.—Leroy's jointed curette.

ment, or rotates the jointed lever of the other. These few words relieve me from the necessity of entering into descriptions which would be useless, as a considerable number of these instruments have no practical utility.

Ravaton's grooved needle is one of the oldest of these instruments; a spring, which slides in a tubular needle that is passed below the body in order to raise it, is pushed outside of its canula, and thus forms a useful hook.

Bégin [1] has more recently devised a curette-stylet which is but little known. Vidal's spring curette very much resembles Ravaton's; the objection to these instruments is that they do not have sufficient power, because the spring flies back on performing extraction. This inconvenience is less marked in Leroy's curette, which is a miniature of the one devised by this ingenious surgeon for the extraction of urethral calculi. But Leroy's jointed curette does not always give a sufficient point of support for making traction when the foreign body is fixed. Thus, Sapolini [2] saw this

Fig. 96.—Jointed curette. (Collin's model.)

instrument break in his hands three times during attempts at extraction, and always at the articulation of the two pieces. He also makes the objection, which holds with regard to hooks as well as to curettes, that the body can never be drawn in the axis of the canal, and this fact may be attended with disastrous consequences when the bodies are irregular.

Blanchet had an instrument constructed by Charrière, which differs from Leroy's currette in the following particulars: 1, the instrument may be manipulated with one hand; 2, the curette turns in all directions; 3, in order to straighten the curette it is sufficient to press upon a button, and, by pushing upon a spring, it can be instantly lowered.[3]

Duplay's forceps.—One blade is mounted on a handle, the other is

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[1] Éléments de pathologie, p. 251.
[2] Annales des mal. de l'oreille et du larynx, T. II., p. 193.
[3] Gaz. hebd., 1867, p. 315.

movable and acts on a double joint, which enables two hooks, forming a fine and delicate forceps, to be opened or closed. The curve of the instrument does not prevent illumination, and it is sufficiently slender to penetrate deeply. There is no doubt that this forceps may be useful under some circumstances. (Vide Follin, T. IV., p. 43.)

4. *Loops.*—Loops have been very rarely applied; they are based on the same principles as the preceding instruments, and must pass behind the body in order to be brought into action. Some are metallic, like double hair-pins; other of metallic wire, hair, etc. One author [1] has advised that a horse-hair, six inches long, be taken and be formed into a loop, which is introduced into the ear, the patient being placed on one side. Torsion movements are then gently performed, and the foreign body will be caught by the loop in the first or second revolution. It is evident that the indications for these measures are very rare. Troeltsch succeeded in removing a foreign body from the cavity of the middle ear, in a case in which other measures had failed, with the aid of a loop tightened with a ligature-tightener.

Observation.—"In a case in which a small tin ball, three and a half millimetres round, had been pushed through the tympanum into the middle ear, I vainly attempted to carry it into the auditory canal by injections of water and air through the tubal catheter. Finally, the idea struck me of surrounding the little ball, which could be seen behind the ruptured membrana tympani, with a loop of iron wire, by means of Wilde's snare, and I then succeeded in removing it without the least pain." (Traité des malad. de l'oreille, p. 129.)

Despite this successful case, the use of loops is one of the measures which is least employed, and hooks usually succeed in cases in which it is possible to surround the body with a wire or metal loop.

5. *Curved forceps.*—Surgeons have long endeavored to devise curved or bent forceps which enable the foreign body to be seized in front and behind, or upon the posterior segment. The instrument constructed by Mathieu is composed of two blades, one of which is articulated after the manner of Leroy d'Étiolles' curette.

This bent forceps may do good service in cases in which the body is not large; but, if the foreign body fills the entire canal, it deserves the same reproach that may be made against all forceps, viz., that it pushes the body toward the tympanum.

According to Bourgeois, a good extractor can be constructed upon a model similar to a vesical lithotrite, and composed of a female blade jointed like Leroy's curette; it becomes curved after it has passed the obstacle, and then becomes opposed to the male blade. Unfortunately, this instrument is almost entirely inapplicable.

Sapolini thoroughly studied the conditions of the problem, and recognized that none of the ordinary models were practical.[2] This author devised a curved forceps which divides into two blades after its introduction. The following is the description which he gives of it:

"At the extremity of a cylindrical tube is fixed a small, relatively very strong plate, and this small brass plate, about one centimetre long, is generally curved so as to present an internal concavity. The tube contains a wire or mandrel, which is provided, at the lower end of the tube, with another small plate having the same curve as the first, so that the back of the second plate fits exactly into the concavity of the

[1] The Med. Press and Circular, 1875.
[2] Ann. des malad. de l'Oreille et du larynx, T. II., p. 193.

first, and both appear to form one when they are brought together. The second plate is shorter than the external one by a millimetre and a half. At the upper end of the tube is a dilatation in which is fixed the mandrel, which carries the inner curved plate, so that the operator, by holding the cylindrical tube immovable, can make the small inner plate turn and describe a circular line. In order that the blades should not be separated during the introduction of the instrument, a screw is placed above which renders them immovable. When the instrument is introduced behind the foreign body, the operator impresses a circular movement upon the inner blade, which passes around the foreign body. When a semicircle has been described, as is shown by the contact of two black points, all that remains to be done is to patiently pull upon the instrument."

6. *Injections.*—Of all measures, injections are undoubtedly the most useful, the most simple, and the least dangerous. Even the ancients had recognized their efficacy, but they advised them rather as an adjuvant and preparatory manipulation than as a curative method. It is not until the beginning of this century that we find them appreciated at their true value. Mathias Mayor of Lausanne is one of the first surgeons who recommended the use of irrigations as a means of extraction. In the beginning the injections were not very successful, and their utility remained unknown for a very long time, despite the warm recommendations of Guersant, Toynbee, Troeltsch, etc. A little later, Sirus Piroudi conceived the idea of employing these injections in a somewhat different manner. He did not make the irrigations into the canal, as Mayor did; he introduced, between the foreign body and the mucous membrane, a fine gold canula adapted to an Anel's syringe, by means of which he injected a few drops of fluid behind the body, and which, upon accumulating there, tended to push it forward. He applied the term hydraulic lever to this ingenious measure, which often proved successful.

However, the injections are usually made in a somewhat different manner, and they facilitate the extraction by a very interesting mechanism. The water or other injected fluid insinuates itself between the body and the walls, and fills the deep cul-de-sac; the current, being arrested by the resistance of the tympanum, turns back, and, during this latter movement, moves and displaces the foreign body and carries it toward the exterior. I have supposed that the foreign body has only been in the canal for a short time, and is not too large. Affairs do not run the same course if it has been fixed for a long time and is incrusted with cerumen, as the injections then have the preliminary effect of disintegrating the concretions, and for this purpose must be continued for a long time.

Various instruments and fluids are employed in making injections. All forms of rubber syringes may be used to advantage. If we foresee that the injections must be somewhat prolonged, we should replace these instruments by an ordinary irrigator. Some surgeons advise a strong stream; others, on the contrary, recommend that it should not act too violently, in order to avoid accidents. In like manner, some prefer cold water, some lukewarm, and others, finally, warm water; the majority prefer water at the temperature of the human body. Troeltsch employs soap-water; Gruber[1] of Vienna uses special fluids, according to circumstances; thus, he uses a one per cent. solution of sulphate of zinc when the bodies are dry grains, and dilute lime-water for other bodies. If the body is incrusted with cerumen, a solution of carbonate of potassa or soda is useful.

Finally, before leaving this subject, I will also mention insecticide injections, which have been recommended for killing animals introduced

[1] Allg. Wien. med. Zeit., 1872, 42–43.

into the ear. Among the most useful, Triquet mentions injections of oil, a solution of corrosive sublimate, a decoction of wormwood, absinthe, sea-moss, etc.

The position of the body is not indifferent; the individual should be placed in the lateral decubitus, on the side of the affected ear. He must also be directed to open the mouth widely, according to Debout's judicious advice. In fact, this movement enlarges the auditory canal very appreciably, and it is sufficient to put a finger in the ear while this movement is being executed, in order to satisfy ourselves of this fact.

In addition to these injections, I will also mention the insufflations of smoke which had been advised by Morgagni[1] for insects in the ear. Tillaux has recently extolled the efficacy of tobacco-smoke under similar circumstances.

2. Various Measures.—Circumstances have sometimes forced the surgeon to adopt exceptional measures, which only answer a very small number of indications. Some act upon the foreign body itself, which they cut or break; others are really indirect methods of extraction, and only possess a moderate amount of interest.

It sometimes happens that irregular or pointed bodies are embedded in the walls, and that it is impossible to disengage their points or to extract them without producing serious injury. It is in cases of this kind that we perform section, if this is possible. Thus, grains of oatmeal, corn and straw have been readily extracted after their division. Small cutting-forceps or iridectomy scissors are used for this purpose.

The methods of division vary somewhat when the bodies cannot be cut. Thus, injections have been used in order to soften and disintegrate pellets of paper, crumbs of bread, cotton, etc. If swollen peas or grains have become soft, it is sometimes possible to divide them in pieces. These measures, when somewhat modified, may also facilitate the extraction of friable bodies, like certain shells and glass beads. But this operation may expose the canal to danger, and, *a priori*, should be resorted to only in exceptional cases. Le Fort attempted to break a foreign body which he thought was an enamelled doll's eye, but which was in reality a doll's head.[2]

A few years ago, Voltolini conceived the idea of destroying by combustion certain organic foreign bodies which resisted ordinary means of extraction. However, this idea is not novel, and, if it possessed more importance, the priority would have to be given to Guerin who, according to Renault,[3] in a case of otitis externa, which was kept up by a cherry-pit entirely closing the auditory canal, determined, after unsuccessful attempts at extraction, to carry a red-hot stylet, in the middle of a canula, up to the pit; this pierced it on the outside, and the introduction of a small hook terminated the operation." Voltolini[4] employs the galvano-caustic in preference, which he introduces until it comes in contact with the body, guarding the walls by means of a horn tube. This method exposes the patient to great dangers, and I only mention it as a curiosity; even its author restricts its use to cases in which the bodies will undoubtedly produce accidents, if they cannot be otherwise extracted.

I will mention, as an example of the indirect measures, the use of injections of water into the Eustachian tube, which succeeded in Deleau's hands in pushing a cherry-pit (which had passed into the middle ear, after

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[1] Morgagni, XIV.
[2] Société de chirurgie, 1868.
[3] Renault: Thèse de Paris, 1831, 187.
[4] Monat. Ohrenheilk., 105, 1876.

having perforated the tympanum), into the auditory canal and nearly to the meatus.

In the latter group, we may perhaps place the strange measures employed by the ancients, viz., the indirect and mechanical measures based on the force of inertia. Among these I will refer to the "plank" measure, the patient being laid in lateral decubitus (on the affected side) upon the board, and this being allowed to fall, in the hope that the foreign body, in virtue of its acquired velocity, will continue its movement. Some other primitive manipulations are reported in history, but we need not insist upon them.

Extraction through Artificial Passages.—Under this title I refer to those operations whose object it is to facilitate extraction through the natural passages; they are adjuvant incisions rather than measures of extraction through an artificial channel. Section of the concha has merely a historical interest, and has been very rarely performed. Hippocrates conceived this idea among other authors who have written on the subject. Without going back so far, it was proposed by Albucasis and Paul of Egina; the latter advised a semicircular incision behind the ear; Tulpius performed it successfully in order to remove a cherry-pit which resisted all other attempts. Modern authors have confined themselves to reproducing this indication in giving their approbation or disapprobation of this operation. Tröltsch is perhaps the only one who has modified the primary measure and endeavored to regulate its employment. According to this author, it is better to make an incision in the upper part of the canal, in order to avoid the posterior auricular artery and to have more room. The auditory canal will then be separated from the squamous portion of the temporal bone; extraction of the foreign body is then performed by using a bent lever. He especially recommends this plan in children, because "the depression of the squamous portion represents in them a strongly inclined plane, so that it extends to the membrana tympani by forming a very obtuse angle." Tröltsch goes even farther when he states that this measure is much less grave, so that it is of no more consequence than any other operation. Experience does not verify this view, as I know of only one case in which recourse was had to incision in order to remove an imaginary foreign body. Duplay is very strongly inclined to accept, in principle, the incision of Paul of Egina, especially if the life of the patient is in danger.

Finally, Tröltsch has also proposed another operation in order to facilitate the expulsion of bodies from the middle ear. It consists in trepanation of the mastoid process, which thus creates an artificial opening through which the foreign body can be seized or pushed, by means of injections, into the auditory canal. I do not know whether such an operation has ever been performed.

The Indications in Foreign Bodies of the Ear.—Since the beginning of the century, the views entertained by authors concerning the therapeutical indications for foreign bodies of the ear have been contradictory, and it is very difficult to form a well-regulated opinion concerning the course to be pursued in the choice and employment of the measures which are at the disposal of the surgeon. We may even say that the use of injections has appreciably modified the indications for treatment. Until recent years, every one admitted without dispute that foreign bodies should be extracted whenever possible, and, in order to effect this object, recourse was had to all the measures which were described above. A more profound study of aural pathology, and the learned works of the

best authors, such as Toynbee, Triquet, Bonnafont, Tröltsch, Roosa, Gruber, etc., have gradually produced a reaction, and many surgeons are agreed in considering the manipulations of extraction as more dangerous than the prolonged stay of the foreign body. Hence, there are two separate camps: that of the advocates of extraction, and that of those who favor expectancy. The majority of French surgeons believe that it is better to extract the bodies than to leave them to themselves. "In France," says Desprès,[1] "we advise the extraction of the foreign body as soon as we have determined its presence, and this is always easily done." Other foreign authors, among whom I will mention Tröltsch in Germany and Roosa in America, are manifestly inclined toward the opposite opinion, and when the body is indolent, they prefer to leave it to nature, which takes the expulsion upon itself or tolerates it indefinitely.

The opinion of these authors undoubtedly rests upon some real facts in a considerable number of cases, viz.: that operative manipulations, and inconsiderate and repeated attempts on the part of those who wish to perform extraction at any cost, are injurious to patients and produce accidents which are frequently more severe than those resulting from expectancy. They are opposed to the common belief which regards the prolonged stay of any foreign body in the ear as a serious matter (Roosa), and they believe that nature sometimes succeeds in expelling them spontaneously (Tröltsch). On the contrary, the defenders of extraction, which has always been adopted, maintain that it is not dangerous unless badly performed, because the first comers, with a no doubt laudable object, aggravate the condition of the patient, and because the physicians very frequently do not make a careful and rigorous diagnosis. Is it not injudicious to leave a foreign body to itself which, although indolent to-day, may to-morrow light up an acute inflammation which is not always easily mastered, and which renders all interference very difficult or impossible, and in all cases dangerous?

These reasons are just, but they are especially so with reference to foreign bodies which have only been in the canal for a short time. They do not hold good to the same extent if they have been present in the canal for a long time, whether they have produced accidents or not. We may therefore state the general indications that all foreign bodies of the ear must be extracted. This very general rule presents a certain number of exceptions which every physician should recognize, and which will save him from mistakes and annoying deceptions.

These counter-indications do not apply, however, to all plans of treatment, but only to those in which instruments are used. Nor do they prohibit injections, which are very useful, almost always harmless, and which should be employed in the beginning. These reservations being made, I will state the following counter-indications.

1. *We must abstain from all manipulations, and restrict ourselves to injections whenever the diagnosis has not been positively made.*

At first sight, this appears to be a commonplace rule which does not concern physicians. In reality it is very important, because it puts an end, if exactly followed, to the very long list of accidents caused by inconsiderate or injudicious manipulations of the laity, or even of physicians. The latter, being summoned unawares, do not always have the instruments necessary to make an exact diagnosis at hand, and hence their attempts at removal can only be blind ones.

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[1] Dict. de méd. et de chir. pratiques, T. XXV., art. Oreille.

2. *When sufficiently prolonged injections fail, the surgeon, before proceeding to other measures, should inquire with the greatest care with regard to the situation, the regular or irregular shape, the volume, fixation, and composition of the foreign body. He must also, above all, assure himself of the condition of the parts, and the existence of inflammatory or other accidents.*

If I insist upon this second rule, it is because there is too great a tendency to the belief that we may make more or less seasonable attempts with any instrument or method whatsoever. Aurists have adopted a different plan, and, apart from the injections, which all agree in regarding as the first and best method, they establish special indications, which they fulfil, according to special cases, by means of this or that method. The surgeon should, therefore, not be positive, and must not always employ the same instrument or the same measure. But what are the special indications? These it shall now be our endeavor to establish.

Special Indications.—The reader will understand the importance of the division of foreign bodies of the ear, according as they are animate or inanimate, regular or irregular, fixed or movable, and according to their consistence or composition. Hence, before attempting anything, we must inquire as far as possible into all these details, because it is better to remain passive than to follow an uncertain path. Some authors establish distinctions according as the body has been present for a short or long period. Two contingencies present themselves in this latter event; either accidents occur, or the body remains indolent. In the first case, the surgeon will act as in the complications of which I shall speak. In the second, it is much better to do nothing, unless the patients distinctly desire to be rid of the object, and then, after the failure of injections, the special rules are applicable.

1. *Animate foreign bodies.*—Injections almost always succeed in expelling insects, and it is unnecessary to resort to other measures unless the latter fail. However, they may be modified to advantage; thus, injections are made of oil, soap-water, etc. If the animal is alive, its death presents a certain amount of importance in order to avoid the horrible pains produced by the movements of the claws or wings. In order to fulfil this indication, resort is had to insecticide injections, to which I shall not again refer, and to agglutinants, which enable the animals to be immobilized and withdrawn at the same time. Bourgeois succeeded in one case by pouring some thick glue into the canal, which immobilized a fly, and enabled it to be removed with forceps. Others have employed forceps and glue, or sticky substances. I will merely recall to memory the apple used by A. Paré, and the milk extolled by Velpeau; all these measures are far inferior to injections made into the canal. Morgagni and Tillaux have advised insufflations of tobacco-smoke; if the pain is very severe, it will be well to introduce a tampon of cotton soaked with chloroform into the canal; the insect cannot survive the vapor, and this measure is less dangerous than the injection of a few drops of chloroform or ether.

II. *Inanimate foreign bodies.—a. Regular bodies.*—I need not revert now to the varieties comprised under this great class: pits of all kinds, peas, metallic balls, beads of glass, pellets of bread, cotton, and paper, are examples of it. Two cases may present themselves, viz., the bodies are either fixed in the canal or movable. The latter condition being the most favorable for removal, I will first occupy myself with it. Whenever a regular body is fixed in the canal, we must endeavor to render it movable

by displacing it. There is no better means of effecting this object than the use of injections made with a somewhat powerful stream and prolonged for a very considerable period. Guersant has sometimes succeeded by merely making injections for eight successive days. Dautand[1] could not extract the terminal cap of a metallic pen-holder until the sixth injection. At times a successful result is obtained only after a very long period, and Bonnafont, whose experience in this direction has been very large, does not make any other attempts until after he has tried irrigations for a long time. They almost always end by displacing the foreign body and by carrying it off.

But when the bodies are hygrometric and capable of swelling, injections do not always succeed in displacing the body. This is the opinion of Lefort and Desprès, among others, who then prefer to resort to other measures. After injections we should resort to hooks, in preference, in order to render the foreign body movable; and the simplest one, the bent pin introduced on the flat, is the best instrument. It is preferable to stylets, curved levers, and curettes, which are introduced with difficulty on account of their size, and run the risk of causing the foreign body to penetrate still farther. With prudence and good illumination, this manipulation, when well conducted, will almost always succeed. If it fails, we must not insist upon it unless very acute symptoms appear. The surgeon will then give the preference to injections in the beginning, and then to antiphlogistics, but a little later will make renewed attempts.

In the second case, the foreign body has been rendered movable or has never been fixed, of which fact we can satisfy ourselves by means of a stylet. As before, we must first resort to weak injections, and then to stronger and sufficiently prolonged ones. They very rarely fail. But if this contingency does arise, we can utilize our instrumental resources, basing them on the properties of the foreign bodies. If instruments can be passed behind the foreign body without any danger, the operator may resort to hooks, curettes, straight and curved forceps, loops or agglutinants, according as one or the other is at his disposal. All these measures may succeed when well performed, but we are rarely obliged to resort to them, as the injections usually suffice. If it is impossible to introduce retropulsors, we must endeavor to remove the body by means of agglutinants. If the object is soft (cotton), it can be disintegrated with a stylet; if it is friable, we may endeavor to break it; but it is better to temporize than to attempt to succeed at all hazards. This is the opinion of Bonnafont and a large number of other surgeons. To sum up, injections should be first employed for regular foreign bodies, and if we are obliged to resort to other measures, simple hooks should be employed in preference.

b. Irregular foreign bodies.—Like the preceding ones, they may be fixed or movable. In the first event we endeavor to move them, a matter which is not always very easy if they are embedded in the walls by several points. If they are irregular and hard, we should not make immoderate haste, and especially should not employ instruments before we have well defined their position, shape, and situation. They are accompanied, more than all other bodies, by swelling of the mucous membrane, which even restricts the field of exploration and manipulation. The best plan, even in these cases, consists in moving the foreign body by means of injections, and, if these fail, by a hook. If they are pointed, like needles

[1] Colin: Thèse de Paris, 1873.

or grains of oats, it may happen that both points or only one become embedded. In the second case we can use the free end in order to disengage the other; in the first, injections are useless, and it is important that the foreign body be cut in two by some means. This section is very readily performed for bodies of moderate consistence, like a grain of corn; it is more difficult in a needle, as in Fleury's case mentioned above. Under these perplexing conditions we must resort to duplicators, which bend the pin or break the needle, the separate fragments of which must then be withdrawn. But even these manipulations are dangerous, and they are only indicated on account of the certainty that the presence of such bodies will produce severe accidents. It is more than ever necessary to act with the greatest caution.

The extraction of irregular and movable foreign bodies is not more difficult than that of regular bodies; it merely demands greater caution. We must use injections, and, if they do not succeed, we must seize the whole or broken body directly by means of forceps, hooks, etc., and with the aid of a good light. We may resort to the numerous methods described in the first portion of this chapter, according to the special cases and indications.

Treatment of Complications.—The physician is not often called to attend the patients until after acute or chronic symptoms have developed. Local or diffuse inflammation is the most frequent of all; then follow pain and reflex disorders. The indication evidently is to remove the body which has produced and which maintains the irritation; but when the canal is swollen, we may use only mild measures, make emollient and expulsive injections, apply leeches and poultices, in a word, resort to antiphlogistic treatment. This is the advice of Itard and the majority of surgeons, and it is very proper, because every blind instrumental interference will result in pushing the body in still farther, producing very violent pains, causing the canal to bleed, and sometimes giving rise to perforations of the tympanum. These manipulations often succeed in aggravating the situation. The indication would be different if the canal were healthy, and if the patients suffered from convulsions or from an intolerable neuralgia. In such cases we must make attempts at extraction (as the swelling does not interfere); but they must be performed with great caution, and careful examination must be made before anything is done. It is in cases of this kind that the surgeon, when he has reached the end of his resources, may resort to superior section of the auditory canal. This method, although not as bad as Malgaigne asserts, does not possess any great efficacy if the body is very deep.

What shall be done when the foreign body has entered the cavity of the middle ear through the tympanum, either spontaneously, or from having been pushed in by unfortunate manipulations? We believe with Voltolini, Roosa, etc., that it is better to remain passive than to attempt extraction, whatever may be the condition of the tympanum. But we must depart from this prudent reserve if the symptoms are very severe and threaten the patient's life. If the presence of the body is positive, the surgeon need not fear to enter the tympanum or open the mastoid cells, in order to make expulsive fluid injections, and, if necessary, to manipulate extracting instruments.

Ménière and Ledentu, thanks to their skilful as well as bold interference, succeeded in removing a small pebble from a child's middle ear.

Observation.—Small pebble in the middle ear.—Incision and injection.—Expulsion of the foreign body.—Recovery.—A child, five years old, had introduced into the ear a

small, flattened pebble, which, in consequence of reckless manipulations made with various instruments, was pushed to the very bottom of the canal. The repeated injections which were then made failed completely; the child was then left undisturbed for several days. However, general and local phenomena of a certain gravity attracted attention, and, among the latter, an alarming facial paralysis necessitated immediate interference. An examination with the otoscope revealed no foreign body along the entire length of external auditory canal, and even the membrana tympani appeared to be intact, but it was slightly swollen and presented a whitish line on its surface. Thinking that the foreign body had penetrated into the middle ear through an opening in the tympanum which had afterward cicatrized, and consequently enclosed the pebble, Ménière, in Ledentu's presence, made a small incision in the tympani with a straight bistoury. A very fine stylet was then introduced with extreme care, and permitted the foreign body to be felt in the centre of the middle ear; but this exploration was considered sufficient. Injections were immediately performed, and repeated several times daily. The pebble was expelled spontaneously on the third day, during one of the injections. (Union méd., 1873, p. 803.)

Finally, we may also resort to insufflations through the Eustachian tube, according to Deleau's example. With regard to the plan of combustion recommended by Voltolini, I think it is better to leave the body to itself than to expose organs which are so sensitive and so near the brain, to dangers which it is difficult to avoid, for the sake of a hypothetical benefit.

The Mode of Operation for Extraction.—I have already described the manner in which injections should be employed. We shall, therefore, only refer at present to the manipulations of instrumental extraction. When we are compelled to perform operations, it is preferable to anæsthetize the patients, on account of the excessive sensibility of the canal, especially in intractable children. All surgeons do not hold this opinion, and Tillaux discards anæsthesia as dangerous. Chloroform is generally employed; but, before its introduction, Ratier had recourse to drunkenness in a child seven years old (to whom he gave Saumur wine), in order to remove a pebble from the ear.[1] Others have been satisfied with pouring a few drops of ether or chloroform into the canal, or placing a tampon dipped in these fluids into the meatus; these measures are less successful. I think that we should not resort to anæsthesia unless there is some irritation of the canal, unless the children are very intractable, and the surgeon apprehends some difficulty.

If the patient is not anæsthetized, he should be placed in a good light, and the direct or reflected rays of the sun, or, in its absence, of a good lamp, should be allowed to fall into the previously cleaned ear. Burckhardt Mercan,[2] in a work presented to the Medical Society of Basle, drew the conclusion that we are only warranted in performing attempts at extraction with forceps, etc., when we are certain of securing proper illumination. An assistant draws the ear upward and backward, thus relieving one of the surgeon's hands, and allowing him to manipulate the instrument in the proper light. Whatever the instrument employed may be, almost all surgeons are agreed in following the inferior wall of the canal, in order to avoid wounding the tympanum; some authors, however, prefer the upper wall.

In a general way we must follow the advice of the majority; but, in practice, we will pass wherever it is possible, and the smaller the instrument is, like a stylet or bent pin, the less danger is to be feared. Instruments introduced on the flat are restored in accordance with their special mechanisms. If the operation is properly performed, no blood should be

[1] Gaz. méd., 1834.

[2] Schmidt's Jahrb., 1876, V., 170.

drawn, and its presence, which interferes with the illumination and the manipulations, should lead us to cease all further attempts until the flow is arrested.

Some surgeons, who have been called to attend patients who have had foreign bodies in the ear for a certain length of time, have employed laminaria-tents to advantage in order to combat the narrowing of the canal consequent on the swelling. This plan should be imitated on occasion.

After extraction, it is well to pour a little oil into the ear, or, better still, a little oil of hyoscyamus, and to introduce a tampon of cotton. If acute symptoms and inflammation develop at the end of several hours or days, it is advisable to adopt antiphlogistic measures.

The Results and Accidents of Extraction.—Extraction of foreign bodies of the ear appears at first sight to be a simple matter, yet it is very often attended with bad results. Even injections, which I described as inoffensive, are open to reproach. Thus, they are said to have given rise, under certain circumstances, to a discharge of blood, perforations of the tympanum, and to syncope. These cases are, however, not only very rare, but they are also not well authenticated, as perforations existed before the extraction, and were due to the foreign body and not to the therapeutic agent employed.

The other methods, especially those which are performed with the aid of instruments, are the cause of frequent accidents, either in themselves or on account of the inefficacy of repeated manipulations. The reader will understand the manner in which they aggravate the situation by recalling that every unsuccessful attempt at extraction inevitably results in pushing the foreign body in still farther. The lesions which may thus be produced are wounds of the canal and perforations of the tympanum. Both are manifested by the escape of blood, which is a bad sign during the operation. The escape of air through the ear, when the patient puffs out his cheeks, the mouth and nose being closed, removes all doubts with regard to the integrity or perforation of the tympanum ; moreover, the examination with the otoscope confirms the first proof.

Bourgeois has endeavored to explain the perforations in an original manner. According to him, when soft bodies are removed, a vacuum forms behind them, and the tympanum and the latter, being pressed upon by the air in the middle ear, is forced outward. The aspiration of the canal, as I have assured myself, is not able to break the membrane, and perforations are more frequent for irregular or large bodies than for those which are soft. These lesions may recover spontaneously, as Lowenberg has shown, but they sometimes become the starting-point for serious inflammations. I have already mentioned a number of cases of death after extraction in the course of this work ; I could readily add some others. A pebble and a coffee-bean have led to death after extraction ; facial hemiplegia occurred in the first case, and suppurative meningitis in the second.[1] In Champouillon's case,[2] facial paralysis, which is a bad indication, occurred on the day after operation ; then purulent otitis developed with meningitis, fever, and death on the fourth day. Dalby[3] also quotes a case of death from meningitis after painful extraction of a stone. We see from these examples that the operation may have serious results, even if we set aside the cases in which the foreign body did not exist,

[1] Wien. Spital Zeitung, 1862, 21. [2] Gaz. des hôpitaux, 1854.
[3] The Lancet, 1845, T. II.

and in which the death resulted from repeated attempts to remove an imaginary body.

The surgeon sometimes thinks that he has removed the entire body when he has only extracted a portion, and it sometimes happens that the remaining part has produced accidents after a longer or shorter period. I will also mention the case reported by Pelletan as an example of this variety of accidents.

Observation.—Paper arrow in the ear.—Incomplete extraction.—Death.—A child introduced a sharp-pointed paper arrow into the ear. It could not be removed on account of the pains which these attempts produced. The persons who first took care of the child broke the arrow, and could only remove a portion of it. Some surgeons were called and increased the mischief. Finally the patient died, and at the autopsy it was found that the point of the arrow had traversed the membrana tympani and had penetrated into the middle ear, the labyrinth, and had even, through a fissure in the petrous portion of the temporal bone, reached the brain, where it had set up meningitis.

A less serious termination followed in a case reported by Gruber of Vienna.[1] This referred to a grain which had perforated the anterior half of the tympanum ; the upper end projected into the canal, and attempts at extraction with forceps remained useless ; injections succeeded better, and there were no immediate symptoms. Pain and a clicking noise during mastication were alone left over. But inflammatory symptoms reappeared at a later period, being caused by a portion of the foreign body which remained in the ear.

An accident during extraction is sometimes the source of later complications, as in the case reported by Fabrice of Hilden.

Observation.—A girl had introduced an artificial pearl into the ear; on attempting to remove the foreign body, it broke. The pieces were imbedded in the walls of the canal, and some were even buried in the membrana tympani. Fabrice of Hilden succeeded in removing them by means of a curette, but not without some difficulty.

Finally, the attempts are sometimes fruitless in spite of everything. This would not be a great annoyance, if the attempts did not aggravate the condition of the patient. Colin[2] quotes the case of a little girl who had a bead in her ear ; a surgeon made fruitless endeavors for a quarter of an hour to remove the body, but they only succeeded in producing a slight escape of blood. Left facial paralysis and inflammatory symptoms developed immediately after the operation; the latter improved, but the paralysis persisted. Death has occurred as the result of the detention of the body after these fruitless attempts, and the deeper the foreign body is situated, the greater are the chances of such a result. In the following case, reported by Maunoir, a stone was situated in the middle ear.

Observation.—Small stone in the middle ear.—Fruitless attempts at extraction.—Death.—Being called to see a child ten or twelve years old, in whose left ear a small stone had been introduced by one of his friends, I found that the little patient had bled a great deal from this ear, and was suffering very much. The physician of the place in which he lived had made long, violent, and useless efforts to remove the stone, which the sound enabled me to discover in the middle ear. An injection of lukewarm water brought away a very large quantity of coagulated blood, but the stone did not come away, and, despite sedatives and antiphlogistics, the child succumbed to a violent inflammation of the internal ear, which had extended to the brain. (Maunoir : Thesis for Fellowship, Montpellier, 1812.)

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[1] Wien. med. Wochenbl., 1855, 21.

[2] Colin : Thèse de Paris, 1873.

These cases, which it is well to know in order that they may be avoided if possible, must be contrasted with the happy results always produced by extraction when performed according to the rules of art. The functional disorders usually disappear gradually, and the acuteness of hearing reappears, if the foreign body has not been too long in the canal. Furthermore, a very intense sensibility of the ear (Tillaux) is sometimes noted, which is so acute that the slightest sound occasions pain. In these very rare cases, the interposition of a tampon at the entrance of the canal readily moderates the hyperæsthesia.

PART VI.—FOREIGN BODIES IN THE NASAL FOSSÆ.

CHAPTER I.

DIVISION.—ETIOLOGY.

Foreign bodies are sometimes present in the nasal fossæ, into which they may penetrate in different ways. Some are accidentally introduced through the nares, others are pushed into the posterior cavity of the nasal fossæ, during deglutition, by a sudden expiration. Finally, some enter by an accidental opening in the walls, the result of a recent or old traumatism. In this section, we shall only refer to the first two varieties, the latter belonging naturally to foreign bodies by "effraction." Moreover, with the exception of a small number of cases, the foreign bodies which are pushed in with violence are situated in the maxillary and frontal sinuses, while the diverticula of the nasal fossæ are only exceptionally the site of bodies which have entered through the natural passages.

The majority of bodies in the nasal fossæ are introduced through the nares, and almost always under the same conditions as those which hold good with regard to the auditory canal. In fact, this accident is especially observed in children who are victims of the disastrous habit of forcing their toys, or other objects which they have, into the natural orifices of the head. The affection is most frequently observed at an early age, but it is not always the result of this habit. A trauma has been known to be the cause of the introduction of larger, and especially longer bodies, than the preceding; they may be forced into the nasal fossæ and produce more or less serious results, without any signs of external injury. Legouest, Larrey, and other surgeons have mentioned cases of this kind which usually resulted from an altercation. Even projectiles of war can enter the nasal fossæ without producing a wound, as is proven by the following example:

Observation.—Piece of shell entering the nasal fossæ through the nares, without an external wound.—A man entered Desnos' service for an attack of bronchitis; it was noticed that he suffered from ozæna. Rhinosocopic examination showed at the upper part of the septum of the nose a black, hard, slightly movable body, which was thought to be a sequestrum, and removed with forceps. It proved to be a piece of lead, three centimetres long in every diameter, which had formed part of a shell. The patient stated that a shell had fallen by his side during one of the battles of the Loire in 1870; at this moment he felt something strike against his face, and his nose began to bleed; he thought it was due to some earth which had been thrown by the shell. Since that time he had always had difficulty in breathing through his nose, and complained of a constant sanious discharge. It is a very curious fact that this fragment had entered the nose without producing an external wound, and had lodged astride the septum, after having perforated it. The edges were blackened from infiltration with the sulphide of lead.

Apart from these causes, surgical therapeutics may explain the existence of a certain number of foreign bodies. Thus, Chassaignac has reported the case of the entrance of a lead canula employed to dilate the narrowed orifice of the nasal fossæ, and which it was impossible to withdraw as usual on account of its disappearance in the cavity. Vidal de Cassis also mentions the case of a tampon of charpie which had been used to arrest a rebellious epistaxis, and which, being lost and forgotten in the postero-superior part of the nasal fossæ, produced very severe symptoms, and finally death. I have not been able to find this exceptional case by looking up the original source.[1]

Insects are sometimes found in the nasal fossæ as they are in the auditory canal; they have been partially inspired, or have entered spontaneously. But these cases are rare, as the natural secretion and normal irritability of the canal are two peculiarities which are opposed to the introduction of animals into this cavity. We must also regard the case of Maréchal of Metz, who saw a centipede enter the nares and lodge in one of the frontal sinuses, as a curiosity which has no counterpart in literature.

I have stated above that foreign bodies may also enter the nasal fossa through the pharynx. It is in this way that leeches, which have been swallowed during the deglutition of water, have been able to fix themselves in the pharynx and travel into the posterior part of the nasal fossæ. Inert substances have been several times projected into the nasal fossæ in two different ways. Either substances have been expelled from the stomach in such abundance that they forced the natural barrier formed by the velum palati and the uvula, and some particles are arrested in the inferior sinuses or in the meatus; or, perhaps, at the time of deglutition, a surprise, fright, a blow, sneezing or laughing, disturb the regular play of the muscles, an involuntary expiration takes place and violently pushes the foreign body into the posterior part of the nasal fossæ. Hickman and Lowndes[2] have reported cases of this kind which occurred under almost identical conditions; they referred to very large metallic rings. The first mode of entrance during emesis is perhaps more common than we would be inclined to believe at first sight, and we can in this way explain the presence of a certain number of foreign bodies in individuals who are ignorant of their presence, as in a recent case quoted by Tillaux:

Observation.—Cherry-pit incrusted in the nasal fossa.—Extraction.—"During the past year a woman sixty-six years old entered my service at the Lariboisière; she was suffering from ozæna, which had begun two years previously. I explored the nasal fossæ with a stylet, and detected, at the upper border of the vomer, the sensation of a denuded, hard, and slightly roughened, but perfectly immovable surface. I diagnosed a necrosis of the posterior edge of the vomer with an adherent sequestrum. I made antiseptic injections for several months, but without any effect; the supposed sequestrum always remained immovable. Lately, that is to say six months after my first exploration, I succeeded in turning it by means of a grooved director, and I removed without difficulty—not a bone, as I had expected, but a round body of stony hardness, having the color of iron filings and the appearance of a small mulberry calculus. After the preparation to which I subjected it, you can readily see that this body is nothing more than a cherry-pit incrusted with a very firm calcareous layer about a millimetre and a half thick, and the introduction of which into the nasal fossæ had occurred nearly three years ago. As the patient had no knowledge of the fact, it must have been introduced from behind forward." (Bull. de la soc. de chir., 1876.)

In support of this explanation, Paulet stated to the society that he knew an individual who could not eat peas without blowing one through his nose.

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[1] Gaz. des hôpitaux, 1830, Dec.

[2] Brit. Med. Journ., 1867.

The very large communication between the nasal fossæ and the Eustachian tube enables us to understand how foreign bodies, in some very rare cases, have been able to lodge in the latter canal. Their presence is sometimes accidental, and is at times due to therapeutical manipulations, as in the following case, of which I will give a résumé:

Observation.—Foreign body in the Eustachian tube.—An individual suffering from chronic catarrh of the middle ear had undertaken to catheterize the Eustachian tube, and employed for this purpose a whalebone, at the end of which a crow's feather was fastened by a silk thread. He proposed to remove the mucus from the tube, and satisfied himself of the entrance of the instrument into the canal by carrying a finger behind the velum palati. One day the thread which fastened the feather to the whalebone broke, and the tip of the whalebone remained in the Eustachian tube. At every act of deglutition he experienced the sensation of a foreign body and acute pain. Nothing could be discovered on rhinoscopic examination, but the contact of the sound gave the sensation of a hard, resisting body. Attempts at extraction with the fingers or forceps remained useless. On the third day, the patient, while again endeavoring to catheterize himself and feeling the whalebone with the catheter, succeeded in removing it by pushing it down with the beak of the instrument aided by the index finger. No bad after-effects. (Monat. Ohrenheilk., IV., 1–5, 1870.)

Another similar case is reported by Fleischmann. At the autopsy of a man, who had complained for several days of ringing in the ears and a peculiar sensibility of the fauces, a grain of barley was found in the Eustachian tube. But these are very rare cases, a knowledge of which will sometimes explain unusual symptoms; their origin may remain unknown for a long time. Finally, a very similar case has been recently reported in a German journal.[1]

CHAPTER II.

NATURE OF FOREIGN BODIES.—SITUATION.—MOBILITY.—FIXITY.

I HAVE collected the foreign bodies found in the nasal fossæ in a synoptical table, taking their chief physical properties as a basis for the division. They are almost the same as those of the bodies introduced into the external auditory canal, with which they present more than one point of similarity. To this class belong the horse-flies, etc., which deposit their larvæ in these cavities, where they develop with astonishing rapidity. But these are not foreign bodies, properly speaking, and I refer the reader to the special works which treat of human parasites. Apart from these larvæ, living insects have been found buried in some cavity where they immediately produce extreme irritation. Science also possesses some cases of leeches in the nasal fossæ; Zacutus Lusitanus quotes a case, and an apothecary of the French army in Spain was also the victim of a similar accident.

Observation.—A leech in the nasal fossæ.—A military apothecary in Spain swallowed some water from a jug, and, half an hour afterward, suffered from persistent epistaxis. He emaciated very rapidly, although his appetite remained good. Three physicians,

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[1] Berl. klin. Wschr., 1878.

who were summoned, prescribed bleeding, which produced no good effects. Three weeks later he introduced into the left nostril a small tampon of charpie moistened with Rabel water. On the following day, while attempting to blow his nose, he felt an unctuous body, which he recognized as a leech, descend the right nostril. He introduced some powdered salt without delay, and the leech immediately fell out. (Rec. de mém. de méd. milit., 1re Serie, T. X., p. 406.)

- Foreign bodies in the nasal fossæ.
  - Animate.....
    - Insects.
    - Leeches.
    - Flies.
    - Centipede.
  - Inanimate.
    - Regular.
      - Mineral and hard.
        - Marbles.
        - Doll's head.
        - Iron ring.
        - Chemise-buttons.
        - Shoe-buttons.
      - Organic and hygrometric.
        - Peas.
        - Beans.
        - Fruit-pits.
        - Kidney-beans.
    - Irregular.
      - Inorganic and hard.
        - Small stones.
        - Piece of shell.
        - Piece of feather.
        - Screw, etc.
      - Organic and hygrometric.
        - Piece of briar-twig.
        - Cork.
        - Bits of wood.
        - Carpenter's pencil.

Animate foreign bodies are never very large, and the annelidæ, which are referred to, change their size in proportion as they develop. These leeches are originally no larger than worms, but little by little they bebecome enormously distended. This fact is so well known that it is unnecessary to insist upon it. These are almost the only living beings which, as the preceding example shows, can live for any length of time in the nasal fossæ, since other insects become enveloped in the mucus and perish.

Inanimate bodies, whether regular or not, are also never very large; the narrowness of the orifices and the cavities explains this peculiarity. However, they may be very long, and some have been found which were five or six centimetres in length, such as pencils, pieces of wood, etc. There is a certain difference, with regard to volume, between bodies which enter through the nares and those which are lodged in the posterior part of the nasal fossæ. The latter are usually larger, and among them may be mentioned metallic rings several centimetres in length and one centimetre in width.

Almost all these foreign bodies belong, in a general way, to two classes: one, which is represented by pits, beans, pebbles, etc., is regularly or irregularly cuboid; the other assumes a cylindrical or prismatic shape, with one axis much longer than the other.

All stems of plants, pencils, pieces of wood, and lead sounds, belong to this type. These considerations possess a real importance, as they may immediately put us on the track of the diagnosis and of the therapeutic measures which should be applied. In addition to these general views with regard to the shape, we must also recognize the existence of regular and irregular bodies. The cubic shape includes almost all the regular objects, like grains and fruit-pits, beads, etc. I make an exception, however, in favor of pebbles, which sometimes present irregularities. But these are not comparable with those of the irregular and elongated bodies which

enter the nares accidentally. A man falls into a hedge while drunk, and forces into his nose a piece of briar-twig, containing thorns and cut like the beak of a flute. More or less irregular and pointed bodies, like pieces of wood, etc., are almost always more dangerous than others.

Among the properties which interest the surgeon, I will also mention their composition and consistence; they are divided from this point of view into organic and inorganic, hard and soft, changeable and unchangeable. Those which are hard, like marbles, or china buttons, do not change their shape in the cavity; while those which are organic, like peas and beans, imbibe the natural moisture of the mucous membrane, and swell up; finally, some are friable, like porcelain and glass.

Situation, Mobility, Fixation.—Foreign bodies have been found in almost all parts of the nasal fossæ, at the top as well as at the bottom; they are usually, however, situated on the floor. Desprès does not admit that the method of penetration can have any influence on the situation occupied by the foreign body. However, the majority of those which have entered during emesis or during a wrong movement in deglutition, occupy in preference the postero-superior part. It is in this situation that the cherry-pit was situated in Tillaux's patient, and that the rings were embedded in Lowndes' and Hickman's patients, etc. A sudden inspiration or inconsiderate manipulations may evidently push a body into the postero-superior portion on a level with the superior turbinated bone. But these cases are infrequent, and we may state, in a general way, that the foreign bodies are situated in the anterior or posterior portion of the floor, being sometimes suspended between the turbinated bones and the vomer. I have elsewhere spoken of the almost absolute impossibility of the entrance of foreign bodies into the sinuses through the orifices which open into the meatus, though noting the curious exception reported by Marechal; the narrowness of the openings which gives access to these cavities does not permit the introduction of the bodies. In determining the position, we must also take into account the size of the foreign bodies, because there are some which cannot be fixed in certain spots except by producing injury, perforations, and lesions of the very thin bones which fill the cavity of the nasal fossæ. Those which are regular, like fruit-pits, may enjoy relative mobility in the first period of their presence; but they are gradually rendered immovable in consequence of the alterations which are produced around them, or of the swelling of which I have spoken, and which is the exclusive property of organic bodies, such as kidney-beans and peas.

We can readily understand that irregular bodies are usually fixed very solidly; some have even broken through the vomer, and have been firmly embedded in it.

CHAPTER III.

THE CONDITION OF FOREIGN BODIES IN THE NASAL FOSSÆ.—SYMPTOMS WHICH THEY PRODUCE.

When a foreign body has been introduced into the nasal fossæ, it rarely passes entirely unnoticed; but this sometimes occurs when some coexisting phenomenon or special circumstance distracts the attention of the patients. Thus, the inexpressible suffering and malaise experienced dur-

ing emesis prevent any notice being taken of the entrance of alimentary particles, or even of fruit-stones into the nose. At other times the patient, having been rendered insensible from drink at the time of the accident, has no knowledge of the accident which has happened, or even attributes it to a different cause. However, symptoms may appear sooner or later, and so much more rapidly when the foreign bodies are irregular and large. The study of the primary or secondary phenomena is naturally divided into two parts, according as the bodies are tolerated or produce symptoms.

1. Tolerance.—There has never been a case of absolute tolerance, because the presence of even the smallest obstacle always interferes with the passage of air. We may include in this variety a certain number of cases which prove that these bodies have remained indolent for a very long period, being either ignored or forgotten by the patients themselves. Foreign bodies have been several times found, upon autopsy, which had lodged for a long time in the nose of an individual, who not only made no complaint, but was even ignorant of its existence. According to Vidal de Cassis, the *Éphémérides des curieux de la nature* relate several cases of tolerance which had lasted no less than twenty to twenty-five years. These cases are explained by the very slight importance of the nasal fossæ, on account of their extent, and the supplementary action of the other, when one is slightly obstructed. Moreover, the bodies which thus remain inoffensive for a long time are almost all regular, unchangeable, or very hard, such as cherry-pits, small pebbles, certain grains with a hard perisperm.

On the other hand, although the body may remain indolent for a very long time, it may undergo certain modifications, the principal and most frequent of which is calcareous incrustation, which transforms the body into a nucleated calculus or rhinolith.

2. Various Accidents produced by Foreign Bodies of the Nasal Fossæ.—As in all the other natural passages, these accidents may be primary or secondary. They present one peculiarity, viz., that, after an initial period of variable duration, which is usually not serious, they very often pass into a chronic condition, hardly ever grow better, and continue for a very long period without endangering life. A few others do not follow such a course, and, after a primary period similar to that of the preceding, they remain indolent, become incrusted with calcareous matter until they again become irritating, undoubtedly on account of the progress of this incrustation, and give rise to symptoms of an essentially slow course. I will first study the primary symptoms, then the modifications which certain foreign bodies undergo, and finally the chronic symptoms.

1. Primary Symptoms.—The foreign bodies act both by their presence and by a mechanical action. By their mere presence they produce functional and reflex disorders, and irritation ; by their mechanical action, phenomena of compression, which, being added to the preceding ones, give the symptoms a peculiar character. The first effect produced by the arrest of a body in the nose is to produce very intense irritation, on account of the exquisite sensibility of the mucous membrane, which poorly supports the contact of foreign substances. It is soon evinced by pain of a very peculiar character, which produces sneezing; this is a matter of common occurrence which is rarely absent, which may be repeated with great frequency, and promptly fatigues the patient. At the same time, by an instinctive and unconscious movement, the individual makes great efforts to pass air suddenly through the nose, either by a movement of

forced expiration or by a very strong inspiration. If the body is irregular, these natural movements only succeed in pushing it and fixing it still more at the point at which it has been arrested. Hence the lesions, at first superficial, of the mucous membrane, which bleeds very readily, and the patient soon finds that he expels nasal mucus, slightly tinged with blood, much more profusely than usual. This group of symptoms is accompanied by watering of the eyes, and dull, poorly defined pain in the nose, fauces, and head.

The array of primary symptoms is very often different, and some of the preceding phenomena are more marked than the others. If the bodies are very small, sneezing predominates; if irregular, epistaxis soon appears; if large, the obstructive phenomena are more marked, and we find the patients suffocated, their respiration is very much interfered with, and they keep the mouth open. This primary obstruction may lead to compression and obstruction of the lachrymal canal, when the foreign body is situated in the anterior portion of the inferior meatus, as not infrequently happens. Obstruction to the course of the tears and epiphora naturally follow. When irregular or pointed bodies are introduced with a certain amount of violence, we find that they rip and tear the mucous membrane, break the turbinated bones, or are buried in the vomer. When certain projectiles, like pieces of foils, enter the nose, they produce these primary accidents, which are always made evident to the surgeon by a very abundant and obstinate discharge of blood.

I will merely mention the loss of smell on the wounded side in cases of obstruction, as this is an accident which is so much less serious because the patients do not notice it, and because the healthy nostril supplements the deficiency of the obstructed one.

The primary symptoms differ slightly when the bodies are situated in the posterior portions; the bodies then interfere with deglutition, and up to a certain point with audition, as happens when they occupy the Eustachian tube. In this region they produce a very peculiar sensation of fulness, and a fatiguing irritation, which is well known in patients affected with polypi. Finally, they may, to a certain extent, modify the timbre of the voice, which becomes nasal. I will here mention Fleischmann's case, which belongs to foreign bodies of this part.

Observation.—Foreign body engaged in the Eustachian tube.—"A man had complained for several years of a continual noise in the ear, and a very peculiar sensation in the pharynx, which he compared to that of a hair situated in the mouth and fauces. At the autopsy some beard of barley was found projecting from the pharyngeal orifice, whence it extended into the bony portion of the tube." (Tröltsch, and Hufeland and Osan's Journal, 1835.)

The primary symptoms almost always subside, if the foreign bodies are not expelled by natural efforts or surgical interference, and various modifications in their shape or substance are then produced, at the same time that they give rise to irritation of the mucous membrane. We shall now investigate these changes.

2. Changes in the Foreign Bodies.—Swelling.—Incrustation.—Every substance which is capable of permitting the imbibition of nasal mucus finally swells and increases in volume. This phenomenon, which is very slightly noticeable in pieces of wood and very hard fruit-stones, has a much greater influence on the changes in the size of beans, peas, and, in general, of all hygrometric substances, such as paper, cork, crust of bread, etc. It is unnecessary to explain that the conditions under

which they are found are very favorable for such imbibition; they may even give rise to germination, of which several more or less authentic examples have been published. A pea has been known to push out ten or twelve roots on one side, while a sprout projected on the other side. However, these are exceptional cases, which merely demonstrate the great influence of this imbibition. Even metallic bodies, during their presence in the nasal organs, undergo a slow change in their surface, which becomes rusted when they are made of iron, and covered with a superficial layer of sulphates when they are made of lead, like bullets.

But the changes produced on the surface of those which are present for a long time without producing severe symptoms are even more interesting. They are closely allied in their origin to the genesis of the calculi in all the cavities, which form at the expense of the altered products of secretion. Moreover, there is more than one analogy between foreign bodies of the vagina or bladder and those of the nasal fossæ. In the same way that calculi form spontaneously in the bladder, so also rhinoliths are found in the nasal fossæ. These phosphatic and calcareous concretions are formed at the expense of the mucus secreted by the Schneiderian membrane. This variety of foreign bodies was known long before Demarquay's[1] work, since Bartholin had already observed, in 1654, a calculus of this kind which was as large as a pigeon's egg, and had formed around a cherry-pit. Ruysch has reported the case of a large piece of yellow amber which had remained in the nasal fossæ of a little girl for nine years. She suffered a great deal during this entire period, until, while sneezing, she expelled the body surrounded by a stony, chalky substance. These nucleated calculi are usually presented under this aspect, but with some variations, which are due to the nature of the body or to modifications of the secretion. Sometimes, in fact, the concretions are darker, grayish, brown, or blackish, and present some similarity to mulberry calculi. Their shape is almost always spherical or cubic, and their size varies from that of a pea to that of a pigeon's egg, as in Bartholin's case. They present two different types as regards consistence: some are very compact and hard, and can be sawed like stones, while others are so friable that the pressure of the forceps or stylet separates them into small fragments. Their composition is almost the same as that of other calculous concretions, and, according to the analyses of Bouchardat, they are composed of phosphates and carbonates of lime and magnesia, as well as alkaline chlorides and oxysulphides; these elements are united together by dried mucus. The majority of these concretions have formed around a cherry-pit. Literature possesses a certain number of examples, almost all of which have been collected together by Demarquay. I will now mention a few, and some more will be found in the course of this treatise.

Observation.—Calculi produced by a cherry-pit in the nose.—A miller had been supposed to suffer from nasal polypus. The right nostril was completely obstructed; a polypus-forceps which was introduced only succeeded in removing a little clotted blood and some membranous shreds between the blades of the instrument; a hard substance was felt, which was crushed, and resembled sand to the touch. Some charpie dipped in ammonia was introduced into the nostril, but the distress kept growing worse. The polypus forceps, when again introduced, removed some similar debris, and finally a calculus. A cherry-pit was seen where the substance had been crushed; it had been laid bare during the first attempts at extraction, as half of it was blackened by the ammonia. The calculus had originally been larger, and the nucleus must have occupied its centre. The patient recalled that one day, while eating stewed cherries, he had been

[1] Archiv. gén. de médecine, 4e série, T. VIII., p. 187.

seized with repeated sneezing. From that time (eighteen months previously) he continually experienced a sensation of pressure, as if a foreign body were in the nose. At the second visit the calculus entirely obstructed one nostril, and the other in great part; the septum was deflected to the right side. A distinct elevation could be perceived externally near the eye. The patient was entirely cured by the extraction of the calculus. (Demarquay in Archiv. de méd., 4e serie, T. VIII., p. 180.)

Observation.—Calculus in the nasal fossæ observed at the Hôtel-Dieu.—Burrow, aged 35 years, a large, well-nourished woman, although of a lymphatic temperament, consulted Blandin with reference to considerable interference experienced in respiration, and which was referred to the left nasal fossa; fetid suppuration from the nose had occurred for some time. This was produced by a calculus as large as a lentil, which was extracted by M. Barth a few days previous to her consultation. She remained in Blandin's service for four days. Blandin removed some small calculi as large as a pin's head, and others as large as a small lentil, every morning during the first three days. On the third day he removed one as large as a kidney-bean, with a rough surface; the calculus was situated under the inferior turbinated bone. The calculus was sawed through, and a cherry-pit found in its centre. A considerable number of calculi had been removed from this woman; M. Barth had also extracted a large number of small ones. (Demarquay, in Archiv. de méd., 4e série, T. VIII., p. 187.)

Incrusted bodies are very rarely found to be completely indolent, and, as in the preceding cases, the later accidents have almost always attracted the attention of the patients or physicians. Their history is the same as that of large, irregular bodies, which resist incrustation.

3. Secondary Symptoms.—As I have stated above, the secondary symptoms are the result of the persistent irritation and compression; sometimes they follow immediately on the first, sometimes they appear after a longer or shorter period of tolerance. Their beginning is usually subacute and insidious, and, if attention has not been attracted, the patients do not notice them until later. They may even become an object of disgust on account of the fetidity of the secreted products, and still have no suspicion of it. In proportion as the primary irritation increases, the mucous membrane of the nasal fossæ reacts, becomes swollen, while the secretion changes its character at the same time and becomes more abundant and muco-purulent. This swelling is usually not very extensive; at the end of a few days, it is found sharply circumscribed in a small zone around the foreign body and the parts with which it is in contact. The imbibition of hygrometric foreign bodies occurs during this first period, and the phenomena of compression and obstruction are sometimes observed, not alone in the corresponding nostril, but also in the canals and orifices which open into the meatus. It is not very rare to find these phenomena of compression accompanied by neuralgia and radiating pains in the face, orbits, or teeth. The duration of the first period may be very long, varying from a week to several months, and it is continuous with the second without any well-marked transition.

During the second period, abundant and fetid suppuration—in a word, ozæna—appears, and constitutes the most characteristic phenomenon of the presence of foreign bodies. Changes occur, at the same time, in the local condition; the ulcerated mucous membrane granulates around the body, and partially envelops it, as Ferrier has observed. The granulations may be so abundant that the body disappears almost entirely; the slightest contact, even the mere action of blowing the nose or sneezing, will give rise to a sudden hemorrhage. Matters may remain in this state for a very long time, and the patients are afflicted with a disgusting malady on account of the nauseating odor of the pus, the offensive character of which nothing can diminish. Sooner or later the symptoms become more

acute and the patient finally seeks assistance, or perhaps the foreign body becomes movable, is displaced, and spontaneously expelled.

But, in addition to these two terminations, there is another less favorable one, which constitutes a third period. I refer to more serious accidents, such as necrosis, caries, perforation of the bones of the nose, and the more or less remote reaction of these phenomena. Cases of this kind are not extremely rare, and a certain number are contained in the annals of literature. In the milder cases, the chronic inflammation, instead of remaining circumscribed as in the previous cases, gradually spreads in depth, produces a swelling which is sometimes apparent externally, and leads to deformity. In a case reported by Ferrier,[1] a piece of a cork stopper gave rise, at the end of three months, to a puriform, fetid discharge from the nose, which resisted all treatment; a swelling of the superior portion of the right wing of the nose was then produced. At other times the inflammation terminates in suppuration, and the pus collects between the mucous membrane and the bone which it covers. It dose not always find a ready exit so long as the body remains in place; this occurred in Pingault's case.

Observation.—Pit incrusted in the nose.—Abscess.—A woman, aged 80 years, presented herself to Pingault, complaining that she had suffered for some months from a sensation of interference in the nose. With the aid of the speculum, a tumor of a grayish color was detected at the bottom of the left nostril; this was displaced after the lapse of a few days. Pingault then grasped it with a pair of forceps, and after very strong tractions removed a hard body, the extraction of which was followed by an escape of a little blood and a spoonful of thickened pus, which emitted a putrid odor. Recovery. Upon examining the body, the central portion was found to contain a cherry-pit, while the remainder was incrusted material. It was found to be composed of dried mucus and salts, among which the carbonate of lime and oxysulphate of calcium predominated. (Bull. de thérapeutique, T. XLIV., p. 85.)

When these collections form in the soft parts, they may give rise to fistulæ, which open externally or into the mouth. Thus, Hickman observed a fistula of the velum palati, in a case of a foreign body in the posterior part of the nasal fossæ. The history of this case deserves mention.

Observation.—Metallic ring in the nasal fossæ.— Various accidents.—Extraction.—Recovery.—A young girl, aged sixteen years, delicate, very intelligent, presented herself to Hickman in 1866; she was supposed to be suffering from a nasal polypus. She could not blow through the left nostril; the mucous membrane on both sides was red and thickened, but it was impossible to discover anything resembling a polypus. The velum palati was very much swollen, especially on the right side, and a small fistulous opening was distinguished directly above the root of the uvula. A rhinoscopic examination revealed a large, blackish body, with sharply defined borders, in the nasopharyngeal cavity above the velum palati; it appeared to be buried in the soft parts which were swollen around it. Exploration with a stylet imparted the sensation of a hard body, and the finger confirmed this fact. Hickman vainly endeavored to push the body into the mouth by means of an instrument passed into the nares, but he succeeded in pushing it outside by a metallic wire which he bent into the shape of a hook and introduced behind the velum palati with hardly any difficulty, and without any suffering to the patient. It was a brass ring, of the kind which is sometimes used as a purse-slide; it measured nearly two centimetres in diameter and more than one centimetre in height.

The mother recalled that thirteen and a half years previously, the child being then about two years old, the latter was suddenly seized with an attack of suffocation, during which she carried her hand to her throat. The mother introduced her finger and felt the ring distinctly, but it was displaced immediately afterward and could not be again discovered. She was supposed to have swallowed it, though it was never found

[1] Bull. de thérapeutique, 1861, T. LX.

in the stools. A discharge occurred, which was at first sanguinolent and then mucopurulent, and which continued ever since; the nares became impermeable to air, compelling the child to keep her mouth constantly open. The sense of smell, as well as of hearing, was lost; the child remained an invalid and was poorly developed. The first physicians who were consulted were told of the ingestion of the ring, but did not appear to think of explaining the persistence of the symptoms by its presence; others suspected an ulcer in the fauces, a fissure of the palate, or a polypus. Recovery, with loss of substance of the posterior portion of the vomer and the turbinated bones, deformity of the vault of the palate, and a fistulous opening above the uvula. Smell and hearing were restored.

Finally, the persistence of the symptoms and compression sometimes gives rise to denudation of the nasal bones, which become carious and partially necrotic. At a more advanced stage, especially when the body has been introduced with violence, the bony lesions terminate in deviations of the septum, in various deformities, and in perforations which place the two cavities in communication.

Various Terminations.—All the symptoms following the introduction of a foreign body in the nasal fossæ may be included in the following category: 1, tolerance; 2, expulsion; 3, persistence of chronic symptoms.

I have already spoken of tolerance, the conditions which favor it, and the mechanism of its production. But we must remember that it is hardly ever indefinite, and that symptoms appear sooner or later, under the slightest provocation.

Spontaneous expulsion, which is much less infrequent than we would be inclined to believe at first sight, usually occurs shortly after the introduction. Individuals, who are victims of an accident of this kind, instinctively endeavor to rid themselves of the foreign body by forced inspirations and expirations, to which we should also add the powerful effects of sneezing. The expulsion rarely occurs except when the bodies are small and blunt, like those which are introduced during emesis. We must also take into consideration the normal and relative dimensions of the nasal fossæ, the shape of the body, etc.

The long duration of the symptoms is the most frequent termination, and always awakens attention in the end. Pingault's patient was no less than eighty years old when the pains compelled him to seek assistance. I do not think that there is any authentic case of death which has been due to the presence of foreign bodies in the nasal fossæ. With the exception of Vidal's statement in regard to a case of death in consequence of the presence of a tampon of charpie in the nose, I have not met with a single example of a fatal termination. When the affection begins in early life, it may retard the development of the child to a certain extent, as in Hickman's case, which was reported above; this isolated case should, however, be confirmed by others.

Prognosis.—From the preceding remarks, it is evident that the prognosis of this affection is not grave, since the least favorable cases merely terminate in chronic symptoms. However, if we consider the fetid character of the suppuration, we are justified in regarding the presence of the foreign bodies as very injurious, since it gives rise to a disgusting infirmity and to ozæna. In order to establish some distinction among the foreign bodies, we may state that the smallest and most regular bodies are the least offensive, and that, on the contrary, those whose size and irregularities produce symptoms of compression, are more dangerous than others.

Observation.—Concretion formed in the nasal fossæ around a cherry-pit.—Jacquette Lacource, aged 42 years, had suffered for some time from constant pain in the head, and especially in the nose, accompanied by some general symptoms. Dr. Saviales thought at first that he recognized a polypus in the right nostril. He was about to relieve the patient, when erysipelas developed on the side of the head, terminating in an abundant discharge of pus through the affected nostril. The inflammation having subsided, Saviales seized the concretion, which was half an inch long, and almost entirely filled the nostril, with a pair of dressing-forceps. It broke under the pressure of the instrument, and escaped in pieces, together with a cherry-pit, which formed the nucleus of a second concretion as large as a small nut, and full of irregularities. After this the patient recovered. (Demarquay, Archiv. de méd., 4e série, T. VIII., p. 181.)

CHAPTER IV.

DIAGNOSIS.

As the presence of the foreign bodies in the nasal fossæ is not shown by any characteristic phenomena, the practitioner must rely upon the history on the one hand, and upon exploration by the sight and touch on the other hand, in order to make a diagnosis. The latter source of information is much superior to the first, as the history is not always obtainable, and may even lead the surgeon into error. We find, in fact, that children do not confess the accident which has happened to them, either through fear of blame or from dread of an operation. In one case it is also stated that a servant did not dare to confess that a child intrusted to her care had introduced a foreign body into the nose. To such cases, which are not rare, we must also add those in which the penetration has occurred through the pharynx, and almost always without the knowledge of the patient. (Hickman.) However, it is well not to neglect the history, and to make use of this source before resorting to the others.

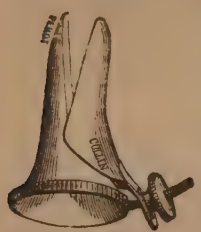

Fig. 97.—Duplay's speculum nasi.

Exploration includes two kinds of methods, according as we employ sight or touch for this purpose; visual exploration should always precede the tactile. We can inspect the first part of the nasal passages by ordinary illumination, but resort must usually be had to rhinoscopy by means of Duplay's nasal speculum and the ophthalmoscopic mirror. These simple means will suffice except in a few very difficult cases. They permit the discovery of the real cause of chronic symptoms which resist all methods of treatment, as in Rullier's case.

Observation.—Foreign body in the nasal fossæ unrecognized for three months.—"This referred to a girl who had suffered from an alarming condition of painful swelling in the nose, and internal suppuration for several months. She was supposed to be suffering from a scrofulous ulcer. The useless employment of a host of remedies led her disease to be regarded as very obstinate, if not incurable. Upon carefully examining the interior of the nose in a good light, Rullier found a foreign body lying obliquely across and arrested in the right nares, about eight or nine lines from the nasal opening. The extraction was easily performed, and the symptoms soon ceased. The body was a softened piece of wood, at least half an inch in length. The child had allowed it to escape into the nose, and the fear of being scolded led her to keep quiet with regard to the accident." (Dict. des sciences médicales.)

However, visual exploration is more difficult when the bodies are situated in the posterior part of the nasal fossæ, and it is then advisable to make use of the inverted laryngoscope. Sight readily enables us to recognize some unusual swelling in this region, but it is more difficult to determine the precise nature of the body, especially if it is covered with mucus or has become the centre of a calculus. In such cases, we must confirm our data by tactile exploration.

The search for foreign bodies can only be performed with the finger when they are situated in the posterior part of the nasal fossæ; but the information which it furnishes is very valuable. We must resort to sounds and stylets for those bodies which are situated in the nasal fossæ, properly speaking. With the aid of such measures, we will avoid mistaking foreign bodies for polypi or of other soft productions; but there is often some uncertainty in making a differential diagnosis from necrosis. This sensation, especially when the body is covered with a deposit of salts, has foiled the sagacity of the most eminent surgeons, among others, Tillaux, Lemaistre, etc. We should then think of the possibility of a foreign body, and do nothing before we possess more ample information.

But if the diagnosis presents difficulties when a careful exploration is made, how much more frequent do the mistakes become if no regular examination is performed. Physicians have several times mistaken cherry-pits for polypi, and have applied the mildest treatment, as in the case in which a surgeon introduced alum for a certain length of time into the nasal fossæ of a man suffering from a foreign body. In the same way, Boyer states that "a pea was mistaken, in a child, for a polypus, and the error was not discovered until after the extraction of the foreign body which had sprouted and pushed out ten or twelve roots, the longest of which measured three inches and four lines." The ozæna, which so frequently accompanies their prolonged presence in the nasal fossæ, and the fetid ichor which escapes, explain the fact that they may be mistaken for scrofulous or syphilitic ulcers, or for caries or necrosis of the bones of the nose. A careful examination, the failure of specifics, and the uselessness of treatment, will clear up the diagnosis sooner or later.

CHAPTER V.

TREATMENT.

The Indications to be fulfilled.—Although foreign bodies of the nasal fossæ do not threaten life by their presence, we must nevertheless extract them in all cases, because, at a later period, they become the source of chronic inflammatory symptoms and of an annoying disease. Moreover, the measures necessary for extraction are not dangerous and never imperil the health of the patients. But the indications are slightly different, according as the body occupies the anterior or posterior portions, as it is well to have the body emerge along its path of entry. The surgeon should be guided in his choice of a method by the shape, situation, irregularities, and even the consistence of the body. In fact, it will be preferable to reduce a body to fragments, which, like concretions, is friable, and whose extraction *en masse* would present difficulties.

1. Means of Natural Expulsion.—Under this head I place the measures based on physiological acts, such as inspiration, expiration, the act of blowing the nose, and sneezing. These minor popular measures are often very efficient in the beginning, and it is rare that they have not been employed before the arrival of the physician. I will not enter into the details of their method of action, confining myself to the statement that they are due to the effect of the current of air which is voluntarily or involuntarily inspired or expired. Sneezing is the most powerful of all these methods, on account of the extreme violence of the expiration. In order to produce it, we must often employ sternutatories, stimulating and irritating powders, like snuff, pepper, and ginger. Breschet mentions a case of success obtained by the use of snuff.

However, these measures will not be followed by any good results unless they are employed shortly after the accident, and unless the body is regular and of moderate size. In fact, in order that the current of air should act in one or the other direction, the obstacle must present a sufficient resistance to the passage of air, without being too strong. A small and irregular, or a very large body, will not realize these conditions.

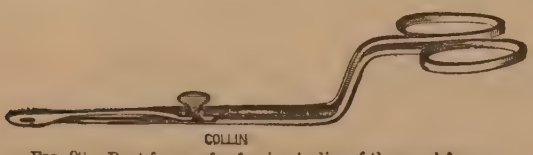

Fig. 98.—Bent forceps for foreign bodies of the nasal fossæ.

2. Extraction of the Foreign Bodies.—They can be withdrawn in two ways: on the one hand by extraction through the nostrils; on the other, through the pharynx. Nasal extraction is done by means of the same instruments that are used for removing polypi, and for operations which are performed in the nasal fossæ. Thus, all authors recommend the ordinary polypus-forceps, and, when this is wanting, the dressing-forceps or forceps of all kinds will replace it. All the instruments described in the chapter on foreign bodies of the ear are capable of application, after a fashion, to the nasal fossæ, and with much greater chances of success. Among others I will mention Leroy's curette and all others

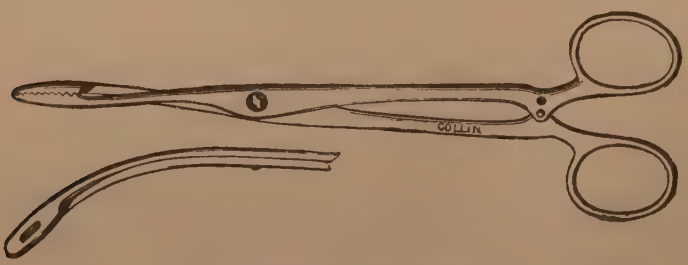

Fig. 99.—Model of Collin's forceps.

of the same kind, and jointed forceps. Durham advises the use of the latter in order to remove a movable body which escapes ordinary forceps. Each blade is introduced separately, and they are then articulated. Pauli[1] had devised a miniature obstetric forceps for the same purpose. Resort has also been had to another measure, which consists in passing a

[1] Bayerischer Med. Corresp.-Blatt, 1850.

very small tampon of charpie into the posterior part of the nasal fossæ by means of Belloc's catheter; the extraction of this tampon will then carry the foreign body along with it. But it appears to me that, in cases in which a Belloc canula can be introduced, the other instruments may be also brought into play.

When extraction by the preceding measures is not successful, we should endeavor to push the body backward and remove it through the pharynx. For this purpose, we try to force it back by means of a sound or stylet, being aided by injections and a suitable light. We should prevent the body from falling into the larynx, and, in order to produce

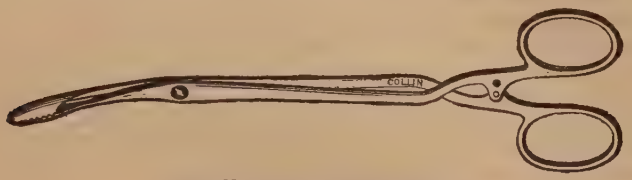

Fig. 100.—Model of Collin's forceps.

occlusion of this orifice, it is well to make some injections of water into the nose, or to make the patients swallow some water.

Finally, under exceptional circumstances, it would be well to follow the plan adopted by Murat in order to extract a spoon, the handle of which was lodged behind the velum palati and the other portion in the œsophagus.

Observation.— Wooden spoon in pharynx or posterior part of nasal fossæ.—"A lunatic, at the Bicêtre, was unsuccessfully treated for angina for eleven days. Murat recognized the presence of a large foreign body which the man had introduced into his pharynx; it was a wooden spoon six inches long. The scooped portion of the object, two inches in length, had penetrated the œsophagus, its convexity being backward. The end was covered anteriorly by the velum palati, behind which it was necessary to introduce the finger in order to feel it. Murat attempted extraction with the fingers and curved forceps, but did not succeed. The velum palati presented an obstacle to the extraction, and he was obliged to make a vertical incision, 6–8 lines long, from below upward, with a probe-pointed bistoury. The blade of the spoon was then seized and drawn forward with a pair of curved forceps. It became necessary to make very strong traction, during which it was feared that fatal asphyxia would be produced. Finally the spoon was extracted; it had remained in this position for fifteen days. (Jour. gén. de méd., 1827, T. CI., p. 138.)

The other forms of extraction are only applicable in a small number of exceptional cases. Their object is to modify the foreign body by breaking it when it is susceptible of fragmentation, or to dilate and enlarge the nasal orifices by means of prepared sponge or suitable incisions. The surgeon very rarely finds himself compelled to resort to these special but inoffensive measures. Crushing is especially indicated with reference to calculi or bodies incrusted with deposits of salts, which impede extraction, or with reference to bodies which are concealed in the meatuses or in the folds of the turbinated bones.

Extraction of Living Foreign Bodies.—I have intentionally passed by, in silence, the special treatment which should be applied to leeches arrested in the œsophagus and pharynx. The following precepts are equally useful for these foreign bodies of the nasal fossæ and pharynx. We can succeed in extracting the leeches by two different methods: either by tearing them from the position which they occupy, or by forc-

ing them, by means of medicated injections, to let go, or by killing them in this manner. When the surgeon is certain, on account of the epistaxis or pharyngeal hemorrhages, that a leech has lodged in these parts, his first care should be to search for the spot in which it is fixed. It is well to examine carefully and on several occasions, in order to observe whether the swollen animal is not visible in one of these parts, either in the pharynx or in the nasal fossæ. It is only in these cases, which are, however, infrequent, that the surgeon will have any chances of succeeding by means of dressing or polypus forceps. But we must not delude ourselves with regard to the value of this method, because it very often happens that the animal escapes from in front of the forceps and disappears. These attempts are more restricted in their use and inferior in efficacy to other therapeutic agents. The latter are very popular, and consist in the injection of salt water, more or less diluted vinegar, alum and water, etc. A somewhat prolonged use of these measures causes the leech to fall and then to be expelled spontaneously or readily extracted. In the pharynx, we can replace these injections to advantage by astringent gargles with the same substances.

PART VII.—FOREIGN BODIES IN THE GLANDULAR DUCTS.

CHAPTER I.

DIVISION.—ETIOLOGY.—NATURE OF THE FOREIGN BODIES.—METHOD OF INTRODUCTION.

If the glandular canals did not escape observation on account of their narrowness or depth, the study of the foreign bodies accidentally found in them would be easier. In the actual condition of science, we only possess a small number of cases referring to canals which are superficial or accessible to examination. Such are, for example, Steno's and Wharton's ducts and the lachrymal canal. There are also a few ancient and modern autopsies scattered throughout literature, which demonstrate the possibility of similar accidents in the excretory ducts of the abdominal glands. Thus, Bouisson mentions an obstruction of the ductus choledochus by an intestinal worm which had engaged in this canal; an analogous case has also been observed with regard to Wirsung's canal; but these rare examples will not enable us to write their history. The number of foreign bodies in the salivary canals is also very restricted, and, by a singular peculiarity, Wharton's canal has furnished the largest share. It alone will be the subject of a special description. During the course of these general considerations I will mention some of the other cases which I have collected with great difficulty.

Nature of the Foreign Body.—Method of Introduction.—The list of foreign bodies found in the glandular ducts is not very large; the greatest proportion are very narrow and elongated bodies which have accidentally insinuated themselves into the ducts. To this class belong the hairs which sometimes enter the puncta lachrymalis (Kneschke, Monoyer), hog's bristles, and the hair of a tooth-brush, found in Wharton's canal. Some are of a different origin, but are similar to the preceding in shape, like the beard of a head of barley, and grasses. In addition to this group, which includes the largest number of cases, are found a few bodies which are somewhat larger, but which always present the same arrangement with regard to shape. Thus, a feather of down, a grain of oatmeal or barley, have been able to penetrate the opening of Steno's duct; even very long splinters of wood have remained for a long time in this canal and in Wharton's duct. Finally, surgical interference has been the cause of accidents of this kind on several occasions. I refer to lachrymal sounds, which have been left *à demeure* in the canal of the same name, and have there become the source of various disturbances, by giving rise to phenomena of irritation and obstruction.

The cause is known very definitely in this case, but it is much less precise for the other glandular ducts. Although we can readily explain the accidental penetration of a hair into a punctum lachrymalis, we can less easily understand the presence of a splinter of wood or a grain of oatmeal in the salivary ducts. This is undoubtedly the effect of chance.

Anatomical Varieties.—In order to understand the course of the symptoms produced by the presence of a foreign body in the canals, it is necessary to establish a distinction according as they have one or two orifices, that is to say, according as the gland is directly continuous with the canal, or first empties its products into an intermediate cavity. The salivary canals are types of the first variety, and the lachrymal canal is the only illustration which I can furnish of the second variety.

The glandular canals under discussion are not very long; and as it is very difficult to displace the foreign bodies, because the contractile walls render them immovable, it follows that they are situated by preference in the external portions of these canals. In fact, hairs do not penetrate very far into the puncta lachrymalia, and salivary foreign bodies are never remote from the orifice of entry.

CHAPTER II.

THE CONDITION OF FOREIGN BODIES IN THE GLANDULAR DUCTS.

1. Primary Symptoms.—Before entering into an exposition of these primary symptoms, I will state that the presence of a foreign body in one or the other salivary canal does not produce any grave immediate symptoms, and that it differs greatly, in this respect, from the other natural passages previously studied. In almost one-half of the cases the patients are unaware of the circumstances connected with the penetration, so slight are the primary symptoms at times. But this is not always so, and attention has sometimes been attracted at an early period by acute pains, which are sufficiently intense at times to produce cerebral disorders. This pain, which is especially observed when the bodies are lodged in Wharton's duct, is explained in various ways: sometimes it is due to the irritation produced by the presence of an unusual body in the canal, sometimes to movements of the part; we must also take into consideration the more or less complete retention of the products of secretion, which gives rise to a feeling of interference, tension, and suffering. The pain is also explained by the irritation which the extremity of the projecting foreign body produces by its friction against the adjacent parts. This is the case with regard to the conjunctiva, which is soon irritated by the hairs introduced into the lachrymal points.

The other phenomena, which appear shortly after the introduction, are obstruction of the canal and retention of the secreted fluid. For various reasons this symptom is not always produced. When the foreign body is very narrow, as, for instance, a hog's bristle in Wharton's duct, it does not prevent the passage of saliva between it and the wall, and retention does not occur. In the same way, the obstruction of one lachrymal point does not entirely oppose the passage of tears into the other

canal; it merely gives rise to interference in the flow of tears, while the retention is much more complete in some other cases. The symptoms of this retention are not well marked, and only in one case have they been sufficiently severe to cause the patient to consult a physician. Cumano's patient experienced very severe pain, so that he could hardly separate his jaws. Hs suffered from lancinating pains on the left side of the base of the tongue in the course of the corresponding submaxillary gland. It soon became swollen and red, and the movements of the tongue were interfered with. All these symptoms were produced by the presence of a straw, which had been introduced into Wharton's duct a few hours previously; in view of the rapidity of the appearance of these symptoms, I can see no other cause for them than the retention.

2. Secondary Symptoms.—Foreign bodies of the glandular canals may be tolerated, when left to themselves, if they do not produce too great irritation, and if they do not obstruct the lumen of the duct. The existence of calculi shows that this tolerance lasts for a very long time, and it has often served as a basis for therapeutical measures. Thus, we are not very far removed from the period in which Philips and others placed lead or silver canulæ *à demeure* into the nasal canal, in order to re-establish the passage of the tears. These sounds may remain for years without producing any symptoms.

Even in the most favorable cases various modifications are produced in the canal, the fluid which it contains, and the gland. Finally, the foreign body, after a certain length of time, undergoes certain modifications—among others, incrustation. The canal soon feels the effect of its presence, and the interference in the discharge of the fluids produces a gradual distention, a sacculated dilatation at its level and above it. The fluid which thus accumulates is not the normal product of the gland, as the latter soon changes under the influence of the irritation propagated to the organ, and from the mere fact of its stagnation. The secretion gradually changes its character, becomes cloudy, and contains a very large quantity of muco-pus, mixed with normal constituents. Moreover, this discharge is not uniform and undergoes alterations of increase or diminution, according as the gland is more or less stimulated. The flow of saliva does not find such a free passage during meals, and hence results an increase in the pain, as in the following case reported by Sheller:

Observation.—Foreign body in Steno's duct.—The brother of the physician who reports this case had felt an induration as large as a 50 centimes piece, at the postero-superior portion of the masseter muscle, for a period of eight months; the induration was indolent, but became slightly sensitive during mastication. For two weeks past the pain had become more intense, especially during efforts at mastication, and, at the same time, a tumefaction developed along the masseter muscle, extending from the ear to the angle of the jaw, so that the patient was disfigured. After a few days he noticed that a foreign body projected into the mouth, in the region of the orifice of the parotid canal. It was expelled by pressure upon the soft parts, and was found to be a small grain of oatmeal, the substance of which had been digested by the saliva. The periodical and apparent swelling of the masseter was caused by the temporary increase in the volume of the parotid. (Schmidt's Jahrb., 1877, V. 176, p. 286.)

The dilatation of the canal gradually gives rise to the formation of true cysts, as was noticed in the preceding observation. Wharton's canal is more subject to this change than others, and gives rise to a curious variety of ranula, to which Claudet has recently called attention. Is it not evident that the dilatation of the nasal canal is almost impossible, and

that the lachrymal sac will alone feel the effect of the closure of this canal? But the discharge of tears can still occur by regurgitation, so that inflammation of the sac occurs very slowly.

The gland itself soon experiences the effect of the interference in the discharge of the secreted fluid, and, in the simplest cases, it is irritated continuously. The mechanical obstruction at first produces an accumulation of the fluid and retention, which is manifested by swelling of the organ, and especially by a very painful sensation of distention or repletion. The region becomes painful, and, at the end of a few days, is the site of a fluxion which may, in some cases, pass on to inflammation. This termination, which is very rare, has been sometimes observed in the parotid and submaxillary glands. When suppuration ensues, the pus collects in the degenerated and softened gland, and always projects toward the exterior, as in the following case:

Observation by H. Senator.—Suppurative parotiditis from obstruction of Steno's duct. —A child, aged 6 months, had a temperature of 40. 6° when Senator first saw it, with apparent inflammation of the right parotid. Upon examining the mouth, a grayish point was found at the orifice of Steno's duct. A foreign body, 4 centimetres long and elongated like a worm, was withdrawn with a pair of forceps. Upon more careful examination, it was found to be a very fine feather of down. Despite this little operation it became necessary to open the parotid abscess. It was impossible to account for the manner of introduction of the foreign body. (Schmidt's Jahrb., 1877, V. 174, p. 265.)

The same termination has been noticed in some other observations of foreign bodies in Wharton's duct, and the pus then appeared at the angle of the jaw. In one case, the suppuration gave exit to the foreign body, which had passed along the entire canal before producing inflammation of the gland. Can obstruction of the nasal canal have any effect upon the lachrymal glands? I do not think so, though we well know that so-called lachrymal conjunctivitis is produced when there is an obstacle to the passage of tears through the nasal passage; such an accident is produced even when the obstruction is mechanical.

It is not necessary that the alteration of glandular parenchyma should be very marked in order to produce a change in the character of the secreted fluid, as its composition is found to be soon modified, even in the slightest cases. Under the influence of the sympathetic irritation, the richness of the saliva or tears in salts is markedly increased, and this fluid, finding a body favorable to deposit in its course, leaves a portion of its phosphates or carbonates, etc., upon it. This is the origin of the calculous concretions which have been sometimes, though very rarely, observed in the glandular ducts.

The small size of these concretions is not astonishing, if we take into consideration the narrowness of the canal and the interference which these calculi produce by their increase in size. However, they are often very large when compared with the very small calculi which are sometimes found accidentally in the canal. They differ not alone in size, but also in consistence, regularity, and even in color. Those which form around foreign bodies are usually long, granular, irregular, friable, while the others are characterized by regularity, hardness, and a spherical shape.

Incrustation always requires a very prolonged stay in order to obtain the production of deposits of any extent; the presence of a thin layer has been observed at the end of a few days in several cases. I will now furnish a rare illustration of incrustation in Steno's duct.

Observation.—Calculus in Steno's duct formed around a small piece of wood.—On the 25th Fructidor, the year 6, Marie Martin, about 50 years old, presented herself at Saint-Eloi Hospital, suffering from erysipelatous swelling of the left jaw, with tension and hardness of the parotid on the same side. The movements of the jaw were interfered with, and the difficulty in opening the mouth prevented the examination of the interior of this cavity. The disease, which began seven days previously, was unaccompanied by fever or any symptom of gastritis, and I attributed it to caries of the teeth, as so frequently happens; the patient complained of some darting pains in the lower part of the affected parotid.

I contented myself with fomenting the affected part with infusion of elder-berries, and the diminution of the symptoms was so great under the influence of this topical measure, that, on the third day of treatment, the pains, redness, and tension, had almost disappeared, and the freedom of the movements of the jaw permitted an examination of the mouth. I then found that the teeth were in very good condition; but I discovered, in the diseased jaw, a circumscribed induration, which was sensitive on the inner, and very slightly so on the external surface, situated in the course of Steno's duct near the opening, the great dilatation of which enabled me to readily introduce a stylet. I satisfied myself in this way of the presence of a solid body in the interior of the duct. With the aid of delicate forceps, I readily extracted the body, which had not formed any adhesions with the surrounding parts; a little pus escaped after the extraction, and the patient had recovered on the eighth day of her admisson into the hospital.

But at this time, when the swelling had disappeared, I found an induration very near the parotid, and similar to the first, and which I thought was formed by a body similar to that which I had extracted; the patient did not wish to submit to the slight incision necessary to remove it. I had the satisfaction, however, of removing it four months later, when it presented like the other, without any inflammatory symptoms.

Each of these bodies had the shape and size of an orange-seed; their tissue presented great analogy with the friable layer which usually covers stones in the bladder. A small bit of wood, upon which the incrustations had formed, passed through the first stone which was extracted; the second had no nucleus. The woman had experienced no pain or other inconvenience except that manifested during the period of erysipelatous swelling; she was also free from symptoms in the interval between the extraction of the two calculi. (Séguignol: Journ. gén. de méd., T. XVIII., p. 69.)

The examples of incrusted foreign bodies in the nasal canal are no less rare, and their presence after a period of variable tolerance terminates in inflammatory complications and slow ulcerations, which gradually displace the foreign bodies. More than once, canulæ which have been left *à demeure* have gradually quitted the canal in order to fall into the nasal fossæ, or even through the bones into the buccal cavity. Desmarres has observed some of these curious terminations. However, authentic cases demonstrate the formation of concretions in the nasal canal, and I will reproduce, as an illustration, the following case taken from Maunoir's thesis; the foreign body was a canula which had been in the canal for fifteen years.

Observation.—Canula forgotten in the lachrymal canal.—Incrustation.—Extraction.—"A few years ago, Mrs. H., of Neuchatel, was operated upon in London by Philips and Wathen for a lachrymal fistula. She did not know what operation had been performed; the result was perfectly successful for some years, but, at the end of ten years, the tears began to flow down the cheeks, the region of the lachrymal sac was engorged, and a tumor soon developed which kept on increasing, inflamed, opened, did not close again, and left a new lachrymal fistula, which was very complete and of a bad character. I did not doubt that a canula had been introduced *à demeure*, and my sound confirmed this opinion. I operated upon the patient by incising the lachrymal sac and introducing into the bottom a pointed, slightly curved steel sound, with the point of which I pushed through the incrustations in the orifice of the canula. Then, bending the sound in such a manner as to form a very obtuse angle with the canula, I made it penetrate, or at least fixed its point in the inner wall of the foreign body, and, in this way, I was able to extract it with ease. The canula was covered with a sort of yellowish, earthy concretion, and its cavity was completely lined with similar matter. The nasal canal had attained a very large size, and a wire, and afterwards a seton, were

readily passed into it. We can readily understand that the recovery, in this case, was more rapid and certain than in ordinary lachrymal fistulæ." (Maunoir: Th. d'agrégation, Montpellier, 1812.)

CHAPTER III.

DIAGNOSIS AND TREATMENT.

The diagnosis of foreign bodies of the grandular ducts is always slow, as the physician is not summoned at the time of the accident itself, but for some of the primary, and especially, secondary symptoms. An individual complains of violent pain in the sublingual region, or in the inner angle of the eye; or a patient presents himself with a tumor in the course of the glandular duct, or a diffuse inflammation in that region. Having no history of the accident, and being diverted from the true path by more or less incorrect statements, the surgeon very often makes a wrong diagnosis, and only succeeds in rectifying it at a later period.

When one end of the foreign body projects externally, the exploration of the region which is the seat of pain furnishes very valuable data. In this way Scheller discovered the end of a grain of oatmeal which projected from Steno's duct, and Vielle the hair of a tooth-brush. In 1836, Kneschke observed a piece of the beard of an ear of corn which projected through the inferior lachrymal point. More recently Monoyer[1] extracted from the same canal a piece of the beard of a head of barley, which projected for one millimetre; he readily performed extraction with the aid of a ciliary forceps.

Finally, an analogous case has been recently observed in the superior lachrymal duct.

Observation by Taylor.—Foreign body in the superior lachrymal point.—"A copper-burnisher had suffered for several days from slight irritation and great pain in the left eye. He consulted an apothecary, who gave him a lotion which had no effect. When he presented himself to our notice, we noticed a yellowish particle projecting from the superior lachrymal point. It was seized with a small forceps and readily withdrawn; it was a bit of copper about a quarter of an inch long." (Annales d'oculistique, p. 86, 1879.)

These illustrations show the advantages to be derived from visual examination; palpation and catheterism are no less useful. They enable us to feel the cystic tumors formed along the course of the canals, and to directly touch the foreign bodies or the calculi when the body has been present for a long time. It is also well to provoke secretion; the escape of a cloudy, muco-purulent fluid after pressure upon a tumor situated in the region of a glandular duct, must necessarily awaken attention.

The differential diagnosis from an ordinary calculus or ranula is always difficult. I will have occasion to revert to this point in speaking of bodies arrested in Wharton's duct. Finally, we must take into consideration the nature of the concretions which are removed from glandular ducts, as their careful examination sometimes reveals the existence of a nucleus.

[1] Gazette de Strasbourg, 1871, p. 124.

TREATMENT.—It is very evident that extraction is indicated. When these foreign bodies are left to themselves, they may become the source of various accidents, which, if they do not threaten existence, disturb the functions, create a disagreeable affection of the canal, and expose the patient to inflammatory symptoms which are not extremely rare. We should extract the bodies as soon as we suspect their presence and their situation is well determined. When one end projects outside, as was mentioned above, the operation is extremely simple. It is sufficient to make use of a ciliary forceps and a magnifying-glass, when this is possible, in order to remove the offending body. A dissecting-forceps may also succeed, as in the following case:

Observation by Demours.—"A piece of beard of barley was introduced, twelve hours previously, into the superior lachrymal canal of the right eye, in a woman aged 45 years, who suffered severe pain whenever the eyelids were moved. It was nearly two lines long, and one end projected slightly from the little canal in which it had engaged. Extraction was readily performed with a dissecting-forceps." (Journ. gén. de méd., T. CIII., p. 450.)

But what course should be pursued if the body has disappeared in the canal and has become the source of a cystic cavity, or of a concretion?

Two plans then present themselves: the simplest and also the slowest consists in dilatation of the orifice of the canal with the aid of a small forceps or of laminaria; the other and preferable plan consists in searching directly for the body by opening the sac, either immediately or after having slit the canal from its orifice. It will suffice to read a few cases of this kind in order to see what means are at the disposal of the surgeon in each particular case. The extraction causes a disappearance of the symptoms if the glandular changes have not been too persistent and profound. *Sublatâ causâ, tollitur effectus.*

FOREIGN BODIES IN WHARTON'S DUCT. (SUBMAXILLARY GLAND.)

CHAPTER I.

DEFINITION.—ETIOLOGY.—NATURE.

Under the term foreign bodies of Wharton's canal, I do not include those which have entered from without by passing through the *ostium umbilicale*. Examples are very rare, and in the whole range of literature it is difficult to collect more than six well authenticated cases, to which we may add a seventh, which is less positive, as the existence of the foreign body could not be determined. We therefore see that these cases are indeed curiosities; but, thanks to the treatise of Surgeon-Major Claudot[1] and the thesis of Chauvet (1877), their history is very well known, and I can do no better than to republish, from the learned treatise of the former author, the description of the symptoms which their presence may produce. To the previously reported cases by Robert, Délery, Claudot, and Chauvet, I will add one by Cumano, which has been passed over in silence, and which verifies in a very precise manner the symptomatology described by these authors.

The circumstances under which the introduction occurred have been well observed in some cases, while in others the patients were entirely ignorant of the cause of their suffering. Thus, Guastalla and Vielle, whose symptoms were the subject of the observations of Cumano and Chauvet, were able to define the origin and mode of entrance of the foreign body.

The former was cleaning his teeth with a wisp of straw eight lines in length. This object slipped from his fingers, during a movement which he made in speaking, and disappeared. The patients of Robert, Délery, and Claudot, on the contrary, were entirely ignorant of the nature of the accident. Gaétan Stanski, in a peculiar treatise published in the *Archives* (1846), expressed the idea that all calculi of the sublingual region were situated in Wharton's canal, and that their origin was due to a foreign body. Experience has shown the absurdity of this idea.

A glance at the very short list of these bodies will suffice to enable us to understand the possibility of this unconscious and accidental introduction. They are usually elongated, pointed, and very narrow; in addition, they present a certain rigidity favorable to their entrance. Among them I will mention hog's bristles, the hair of a tooth-brush, a blade of grass, a

[1] Arch. gén. de méd., 1874.

straw, a fish-bone. The spikelet found by Claudot in the Wharton's canal of a zouave is undoubtedly the largest of these bodies, and the one whose introduction is least readily understood. We can with difficulty accept this surgeon's opinion that it had been present in farina, and had penetrated the canal during mastication; in the absence of any data it is better to refrain from expressing an opinion. I merely wish to again call attention to the fact that the arrangements of these spikelets renders their introduction in one direction very easy, and also corroborates the epithet "progressors" which Bégin applied to them. When we reflect upon the astonishing cases of certain of these grains which have formed abscesses in the thoracic walls, after passing through the œsophagus or bronchi without attracting the attention of the patient, there is nothing remarkable in the fact that the same bodies can pass into a natural canal, even though it is as narrow as the duct of the submaxillary gland.

CHAPTER II.

THE CONDITION OF FOREIGN BODIES IN WHARTON'S DUCT.—PRIMARY AND SECONDARY SYMPTOMS.

Every foreign body arrested in Wharton's duct produces symptoms varying in intensity, which are the result of its presence and mechanical action. As these two factors almost always coincide, it is very difficult to determine precisely what part is due to the irritation, and what to the interference in the excretion of saliva. However, in view of the shortness and narrowness of the duct, we are justified in believing that both are associated in producing the series of symptoms. But the part attributable to the irritation is very marked in certain cases, especially when the primary symptoms occur early and are very intense. I will therefore divide the symptoms into two categories, according as they are primary or secondary.

1. Primary Symptoms.—While some persons only experience an indistinct sensation after the entrance of the foreign body, there are others in whom the symptoms assume a terrible intensity in less than twenty-four hours. In some cases (Chauvet, Claudot, Robert) the patients felt nothing, or only a slight sensation, which did not prevent them from sleeping or pursuing their occupations. They experienced rather a feeling of distress or irritation, presenting a characteristic of suddenness, whose importance is judiciously insisted upon by Claudot. As an illustration of the slight primary symptoms, I will quote the following case reported by Vielle, and published by Chauvet.

Observation by Vielle.—Hair of a tooth-brush in Wharton's canal.—"About 10 o'clock P.M., April 6th, 1877, I felt a smarting pain, heat, and very severe pricking in the region of the tongue; I was so distressed that I could not perform any movements of deglutition or suction; every movement of the tongue increased my slight suffering. Desiring to account for this unusual phenomenon, I very carefully examined the region, but, despite my eagerness and the extreme care which I employed in my examination, I could discover nothing. No redness, no ulceration, no foreign body to

explain the pain, which rendered me uneasy and roused my curiosity for an explanation. I lay down in bed, and my sleep, which was not at all interfered with by the slight distress, was calm and deep, like that of a perfectly healthy man. Upon waking, the movements of the tongue gave rise to the same pain as during the night previous, but direct examination showed a slight redness in the midst of the ostium umbilicale. The mucous membrane at this point was swollen, tense, œdematous, and the heat and pricking were thus due, to a certain extent, to this cause. There was nothing to be done at this time, as there was no indication to fulfil. I visited the hospital, in the morning, as usual; at midday I felt, during a movement of deglutition, a somewhat more intense pain, and the sensation of a foreign body which changed its position. Then a ray of light burst upon me: I recalled a clinic which had been given at Saint Louis, during the December course (since published in the *Progrès Médical*), and which treated of the symptoms of salivary lithiasis. Without taking time to look into a mirror in order to see whether anything presented at the opening of the excretory canal of the submaxillary gland, I asked my friend Chauvet to remove a foreign body from my Wharton's duct. The latter saw, in the opening of the canal discovered by Van Horne, something resembling a hair. I looked into a mirror and observed the same thing. There was nothing else to do except remove it, but no instrument or forceps was at hand. The end projected too little to be seized by the fingers; moreover, the fear of pushing it in made us immediately renounce this method of extraction. As no stone is left unturned in a moment of danger, my friend took two matches and seized the end of the foreign body between the two sharp edges of these pieces of wood. At the third attempt, he removed a hair 0.015 m. long. When compared with the hair of my toothbrush, it had the same length, color and consistence, so that there was no doubt in this regard. The painful sensation disappeared immediately; the redness alone persisted, but was gone on the following day." (Thèse de Chauvet, 1877.)

The acute symptoms are not always as mild as in the previous case, and Délery's patient had an initial period of very great intensity, which only diminished gradually. In this case we must evidently take the individual irritability into consideration; this patient was roused from his sleep by violent pains; there was marked swelling of the entire submaxillary region, and radiating pains in the head and face. At the same time fever may develop during the first stage, and the symptoms continue to increase in intensity for a few days. If the affection is stopped in time, the surgeon will only observe the primary symptoms; but, if the extraction has not been made, two results may be produced; either the body becomes indolent, and the symptoms temporarily subside to give way to a period of quiet which lasts for months, or the irritation continues, as in Cumano's case, and inflammation develops; this soon extends to the submaxillary gland and to the peripheral cellular tissue. This variety of symptoms completes Claudot's study, and gives an exact idea of the propagation of the inflammation to the glandular tissue itself. The symptoms are clearly described and well observed, and we find, in the first period, the swollen gland, the difficulty in the movements of the tongue, all the symptoms of the inflammation of the gland and of the peri-glandular phlegmon. There was no remission in this case, as in those of Délery and Claudot, and suppuration developed in less than two weeks; the first abscess was soon followed by a second, which opened into the mouth like the previous one. These abscesses kept on forming so long as the foreign body was present, but they gradually disappeared as soon as the straw was removed. This entire group of symptoms is due both to the irritation and to the obstruction of the canal. Although at first local, the affection soon attacks the gland, and we always find this organ increased in size and more sensitive to pressure, with a diffuse puffiness of the submaxillary region somewhat analogous to that of the parotid in mumps. The abscesses belong to the variety which Chassaignac has called canalicular, and they do not form in the centre of the gland, but in the peri-

pheral cellular tissue, as is proven by their cicatrization and the preservation of the glandular tissue. I will now reprint Cumano's interesting observation.

Observation.—Foreign body introduced into the duct of the submaxillary gland.—On July 22d, Dr. Guastalla was picking his teeth with a wisp of straw eight lines in length. Desiring to bleed the lower gums, he carried this toothpick behind the incisor teeth and under the tongue, while he was speaking; it slipped from his fingers and instantly disappeared. Dr. Guastalla soon suffered very severe pain; twenty-four hours later the pains were so intense that he could hardly open his mouth. He had lancinating pains on the left side of the root of the tongue, in the course of the corresponding submaxillary gland. Shortly afterward these pains were propagated to the corresponding maxillary articulation, to the temporal fossa and ear. The patient could not chew—he was obliged to nourish himself with fluid food; he was threatened with suffocation in consequence of the extension of the inflammation to the fauces. These phenomena were attributed by Cumano to the presence of the wisp of straw in the duct of the submaxillary gland; he prescribed general and local bleeding. August 7th an abscess formed and opened into the mouth, above the gland in question; it gave exit to a salivary and very fetid, purulent fluid; the patient was relieved, but the foreign body was sought for in vain.

August 9th a second abscess formed under the left submaxillary gland, and was accompanied by throbbing pain. On the 13th it opened and gave vent to considerable fetid pus. On the 24th the opening had cicatrized, but the cicatrix remained hard and painful; the patient complained from time to time of lancinating pains. Fresh attacks of inflammation; abscess near the thyroid gland; incision; no foreign body. Three hours later, a wisp of straw three lines in length escaped through the opening of this abscess. A week later, another abscess formed by the side of the previous one. The submaxillary gland was not hard, but the patient complained of darting pains; fresh abscess; then fungous vegetations appeared through the openings in the mouth; the remainder of the foreign body could be felt with a stylet.

September 13th, while the patient was rinsing his mouth, a wisp of straw, five and a half lines long, was expelled spontaneously. Recovery. (Gaz. méd. de Paris, 1838).

2. Secondary Symptoms.—The initial symptoms having subsided, the patient no longer complains, and forgets the accident, if other very slow phenomena are not produced. The inflammation remains subacute during the entire period which elapses between the introduction and the appearance of the symptoms. When the patient seeks assistance, he experiences a sensation of interference, an intermittent pain in the sublingual region, and a certain amount of difficulty in the movements of the tongue. Exploration by the sight and touch disclose, under this organ, a double tumor which is composed of two parts, one anterior, the other posterior and external. The first is formed by a cystic dilatation of Wharton's duct; it is fluctuating, soft, oval, and pear-shaped, with the point turned toward the ostium, and presents the usual symptoms of ranula. When it is pressed upon, a few drops of an opaque fluid are squeezed through the ostium umbilicale.

The other tumor differs from the preceding; it is harder, resisting, painful on pressure, and poorly defined; it escapes under the finger, and palpation (between the hand placed under the angle of the jaw and the index finger placed in the mouth) readily enables us to recognize that it is formed by the submaxillary gland.

These are the lesions observed at the end of a certain length of time, and which may be summed up in the statement that cystic dilatation of the canal is produced, with catarrh of the canal and chronic inflammation of the gland.

On the other hand, the foreign body does not always remain inert, and it has been known to undergo the same changes as foreign bodies of the bladder, for example, that is to say, it becomes the nucleus of phosphatic

and calcareous concretions. This modification occurred four times among the five cases of prolonged stay of the foreign body.

The changes produced in the canal deserve a few moments' attention. They are identical with those in other glandular ducts, and consist : 1, in chronic irritation and catarrhal inflammation of the canal ; 2, in a series of phenomena which are caused by the incomplete obstruction. At first the thick, stringy saliva accumulates behind the foreign body, and its retention soon has a marked effect upon the gland ; the initial swelling and pain then appear. At a more advanced stage the saliva flows between the foreign body and the wall, causing at this point an ampullary dilatation which transforms the canal into a true ranula. At the same time the pouch, being irritated by the contact of the foreign body, becomes inflamed and secretes a muco-purulent fluid, which escapes spontaneously, mingled with saliva, or is only expelled during movements of the tongue, or under the pressure of the finger. This chronic inflammation, being propagated to the gland itself, produces inflammation of the latter organ. The deposits of incrustation are derived from the secreted saliva, the properties of which are changed and which become charged with a larger quantity of salts.

The following case, reported by Chassaignac, corresponds very well to the previous description.

Observation.—"I have communicated to the Surgical Society (July 18, 1849) the case of a man who presented an illustration of inflammation of the submaxillary gland, with dilatation of Wharton's duct. The lesion was produced, according to the statement of the patient, by a piece of straw which had entered the mouth. If the point of the tongue was raised and a little salt was thrown on the floor of the mouth, the saliva was found to flow in abundance from the healthy duct. If, on the contrary, the affected side was compressed with the fingers, a little drop of pus was expelled. The affection finally recovered spontaneously."

Despite the uncertainty of an exact diagnosis, we should, in view of the analogy of the phenomena, place faith in the statement of the patient. There is no room for doubt in the following case, a succinct account of which is found in a foreign journal.

Observation.—Calculus in the submaxillary gland.—Abscess.—Expulsion.—A man entered the Middlesex Hospital for an abscess in the submaxillary region. It opened spontaneously, and a calculus escaped, whose nucleus was a small piece of wood. It must have penetrated into Wharton's duct, and then into the substance of the gland. (Monthly Review of Dental Surgery.)

When the body is not expelled spontaneously, the affection may run a somewhat different course. The foreign body gradually becomes more irritating, and finally ulcerates through the wall of the pseudo-cyst which contains it, as was observed in Robert's case. In this patient a small opening formed accidentally at a little distance from the ostium umbilicale. These ulcerations are produced by the constant pressure of the foreign body against the dilated wall of the canal, and it will escape through them sooner or later if the patients are left to themselves.

Observation.—Hog's bristle introduced into Wharton's duct.—"In Sept., 1829, I was consulted by a man, aged 40 years, the janitor of the house in which I lived. For some time past he had had a slightly painful swelling in the right submaxillary region ; it presented frequent variations in size, although usually quite large, and frequently alternating with a muco-purulent discharge which escaped through the lower part of the mouth.

The submaxillary gland passed beyond the level of the lower jaw, and appeared to me to have tripled in size; pressure upon it produced a very profuse discharge through the ulcerated orifice of Wharton's duct, and through another small accidental opening in its vicinity. I first suspected the presence of a salivary calculus, a large number of which are reported by authors, but a stylet, which I attempted to introduce, penetrated an inch in the direction of the canal, and was then arrested without revealing anything. I thought that the patient was suffering from chronic inflammatory engorgement of the submaxillary gland, which I attributed to his cold and damp dwelling, and treated accordingly. Three months elapsed without any change, until the patient reported to me, one day, that a hog's bristle was projecting from one of the small ulcerations and was pricking his tongue. I extracted it without difficulty by means of a pair of forceps, and in a week the pain and discharge had disappeared. The hair had undoubtedly penetrated Wharton's duct, and the inflammation to which its presence gave rise was propagated to the tissue of the submaxillary gland. I confess that I was far from suspecting such a chain of events, the patient having given me no information which could put me on the track of the diagnosis." (Robert: Soc. anat., 5e année.)

Calculous deposits, when present, are always very small. In the case reported by Claudot, there was a very slight deposit upon the spikelet which had not been long in the canal. The deposit, which had formed upon a fish-bone in Délery's case, measured 4 or 5 lines in length, and 1½ in circumference; it resembled a long, rough dragée. The bone was free at one end, and thus constantly irritated the mucous membrane.

In concluding our remarks on these chronic symptoms, I will publish Délery's and Claudot's cases, which are interesting both on account of the course of the symptoms and of their rarity.

Délery's observation.—Salivary calculus formed around a fish-bone.—"In the beginning of January, 1831, M. P—— ate trout one night for supper, and soon afterward went to bed; he slept soundly until two o'clock in the morning, when he was awakened by intense pains. Respiration was difficult, expectoration very painful; the right sublingual and submaxillary regions were swollen and extremely sensitive to the touch. In a few hours the pain involved the entire head, and was so intense that M. P—— feared that he would go crazy. This condition lasted three days, despite active treatment.

After this violent attack, a respite occurred for six months, during which the pain continued, but was endurable. He was frequently obliged to pass his tongue over the end of Wharton's duct, as is done in order to disengage a foreign body situated between the teeth. After the lapse of six months a fresh attack occurred as violent as the first. The tongue began to turn over on the right side, and had a tendency to be placed on edge; its movements were difficult, and followed by more or less intense pains. He then remained ten months without another attack. However, the tumefaction of the right submaxillary and sublingual regions continued, and these parts were exquisitely tender. As M. P—— was only able to take liquid food, he grew more and more emaciated, so that his family became alarmed. He remained in this condition from 1837–1840, with alternations of attacks and intermissions; the physician then sounded Wharton's duct and found a stone; he delayed the operation necessary for its removal until the following day. Hardly had he left the house, when M. P—— was taken with terrible pains. He ran around the room as if crazy, holding his head between his hands, and uttering piercing shrieks. Upon passing his tongue over the sublingual tumor, he felt a pricking sensation; he looked into a mirror, noticed a point projecting toward the tongue, and recognized the calculus which presented. With the aid of a large pin he removed a stony concretion from the duct.

The calculus was 4–5 lines in length, and 1½ in circumference. It looked like one of the small comfits used by confectioners to fill up their boxes; it was white when extracted, but is now brown. The bone, which is free at one end, projects for a quarter of a line beyond the concretion. The end which presented at the opening of the duct was half as large around as the opposite end; it had a conical shape, which facilitated its progress in the duct." (Revue de thérapeutique, 1853.)

Observation by Claudot (résumé).—Acute, suppurative, salivary ranula, secondary to the introduction of a foreign body into Wharton's duct.—"Julien, aged 23 years, en-

tered the hospital for a ranula. The patient presented a small, fluctuating sublingual tumor on the right side. He stated that it began suddenly, accompanied by malaise and slight fever, and that a few days afterward (Jan. 1st) affairs were in the same condition as at present. Jan. 8th, I found two tumors under the tongue, on the right side. The first was formed by the submaxillary gland, was as large as a pigeon's egg, and projected into the mouth and supra-hyoid region; it was movable and had a firm consistence. The second tumor was elongated, as large as an almond, and situated two or three centimetres in front of the first, of which it was independent; it was movable and projected into the mouth; it was detected with difficulty by supra-hyoid palpation. It was pear-shaped, the large extremity directed downward and outward, the tip corresponding to the ostium. It did not fluctuate freely, but was elastic and very tense. When slightly compressed, a drop of creamy, semi-purulent fluid escaped from the orifice of the duct, from which it also dribbled spontaneously. The mouth was very painful during mastication, but no other local or general disorders.

A diagnosis was made of an acute salivary ranula, caused, no doubt, by an obstruction or salivary calculus. Soothing gargles, cataplasms, and mercurial inunctions under the jaw, were employed. I then decided to attempt catheterism of the canal with Méjean's stylet. I succeeded after some fumbling, and the stylet entered to a depth of 3–5 centimetres without encountering an obstruction. Warm-water injection with Anel's syringe; the contents of the cyst did not discharge more rapidly than before. Similar treatment, with catheterism and injections, was employed for four days. The posterior tumor had appreciably diminished in size; it was softer, and only slightly painful on pressure. The distress diminished, and the inflammatory symptoms improved. The cyst persisted, but fluctuation was more readily detected. Under these circumstances, I decided to open (Jan. 15th). The point of the bistoury struck against a small, foreign body with a rough surface, which was readily extracted. It was a piece of a plant 2 centimetres long, composed of a small central axis and 4 folioles. The pouch was entirely emptied at the first incision; it contained 6–8 grammes of a creamy fluid.

On the following day the purulent discharge had almost ceased, and no trace remained on the 17th. All this time the stylet enabled me to distinctly recognize the communication of the pouch with Wharton's duct. On the 22d, the incision had cicatrized, but the gland remained swollen and indurated. The latter symptoms diminished appreciably, and the patient was entirely recovered by April 4th, with the exception of a slight induration of the submaxillary gland." (Arch. gén. de méd., 1874.)

CHAPTER III.

DIAGNOSIS.—PROGNOSIS.—TREATMENT.

Diagnosis.—Despite the efforts made by Claudot and Chauvet, the diagnosis of foreign bodies of Wharton's duct is none the less very difficult. However, when the symptoms are well defined, as in Cumano's or Délery's cases, we may suspect the presence of a foreign body in the canal. We must not base illusory hopes on the usefulness of the clinical history, because the patients rarely know of the introduction, and the origin is rarely as definite as in Cumano's case. But this is not true of the information furnished the surgeon concerning the primary symptoms, as they possess a real importance. The beginning is almost always sudden in the midst of perfect health, and the pains attain a very great intensity. Ordinary ranuiæ, which are symptomatic of a salivary calculus or of other affections, never appear so suddenly.

Exploration renders the greatest services at whatever period of the affection we may be called. In the beginning we may perhaps notice a portion of the body projecting externally, as in Chauvet's case. At the

end of a longer period we readily recognize by sight and direct touch the existence of two tumors, the one corresponding to the submaxillary gland, the other to a salivary ranula. If the canula is permeable, of which we can satisfy ourselves by catheterism, we should make a diagnosis of obstruction of Wharton's duct, either idiopathic or symptomatic of a calculus or a foreign body. "The simultaneous and sudden appearance of an acute salivary calculus, and of inflammation of the submaxillary gland, allows no other diagnosis than that of a foreign body in Wharton's duct. I do not think that we can mistake it for a calculus if we pay careful attention to the previous history." Claudot thus clearly lays down the elements of the diagnosis. There are unfortunately cases of idiopathic obstruction, due to a lesion of the canal or adjacent parts, so that the diagnosis will not always conform to the truth. Exploration with a stylet forms a good measure in cases of calculi which are not situated deeply; but it only gives uncertain results when the object is very thin, like a hog's bristle.

Moreover, a differential diagnosis is of secondary importance in the question, because, whenever an acute, purulent, salivary ranula is present, the indication is to incise the tumor, and thus to remove the obstacle to the course of the saliva.

Prognosis.—The presence of foreign bodies in Wharton's duct is not a grave affection, but it is very painful and distressing on account of the severity of the initial symptoms. When they have disappeared, the affection presents an essentially chronic course, as in all cases of salivary lithiasis, and it never has any well-marked effect on the general health. This disease remains stationary in its chronic course if the surgeon does not interfere, and becomes a distressing affection, which may terminate at the end of a longer or shorter period by ulceration of the cystic cavity and expulsion of the foreign body, which has become the centre of a calculus, through this artificial opening. The induration of the gland persists for a very long time after extraction.

Treatment.—Here, as in almost all the natural ducts, the two measures open to the surgeon, in order to relieve the organism of an irritating foreign body, are extraction through the natural or through an artificial opening. On account of the narrowness of the small opening which gives access to the canal or to the ranula when present, we must not resort to extraction through this path unless a portion of the foreign body projects externally, as in Chauvet's case. But this is exceptional, and we should not adopt the same plan unless the symptoms are very recent, as the point of an incrusted foreign body may project, and yet the extraction will not be easily performed without a slight rupture.

Whenever a ranula is present and we are justified in suspecting the existence of a foreign body, whether incrusted or not, the indication for incision of the pouch is very clear. For this purpose a small, pointed bistoury is used, with the aid of which an incision is made for about a centimetre along the long axis of the pyriform tumor. The point of the instrument usually enables us to feel the calculus or foreign body, and to extract it with a forceps, or to dislodge it with the point of the bistoury. The cystic cavity, being laid bare, empties its muco-purulent contents into the mouth, and the saliva freely resumes its course.

The edges of the wound gradually come in contact, and, after a certain length of time, the incision is only indicated by a slight cicatrix.

But even if it does not recover, it will result in a fistula, or rather, a displacement of the ostium without any other inconvenience.

There is no necessity of employing symptomatic treatment when the diagnosis is clearly made or even suspected. We may endeavor to arrest the progress of the inflammation of the submaxillary gland and of the acute ranula by antiphlogistics, but we must remember that these measures are very often ineffective, and, at all events, inferior to the incision which, by removing the obstacle, more certainly arrests the progress of the inflammation. We must resort to it if a case like that of Cumano is presented to the practitioner.

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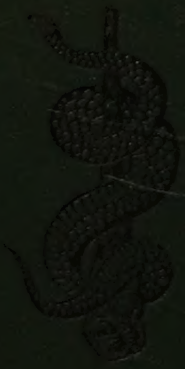

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